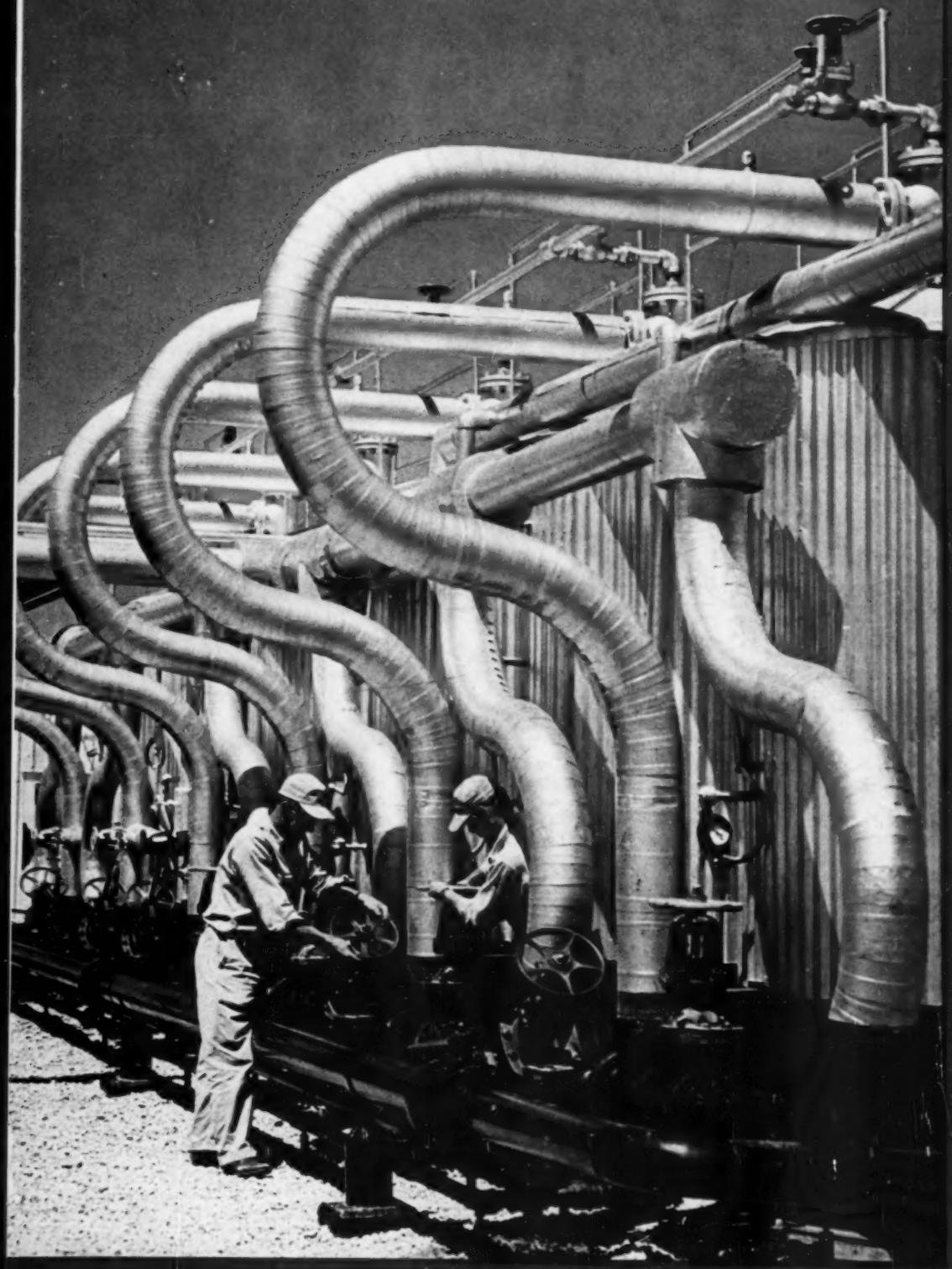
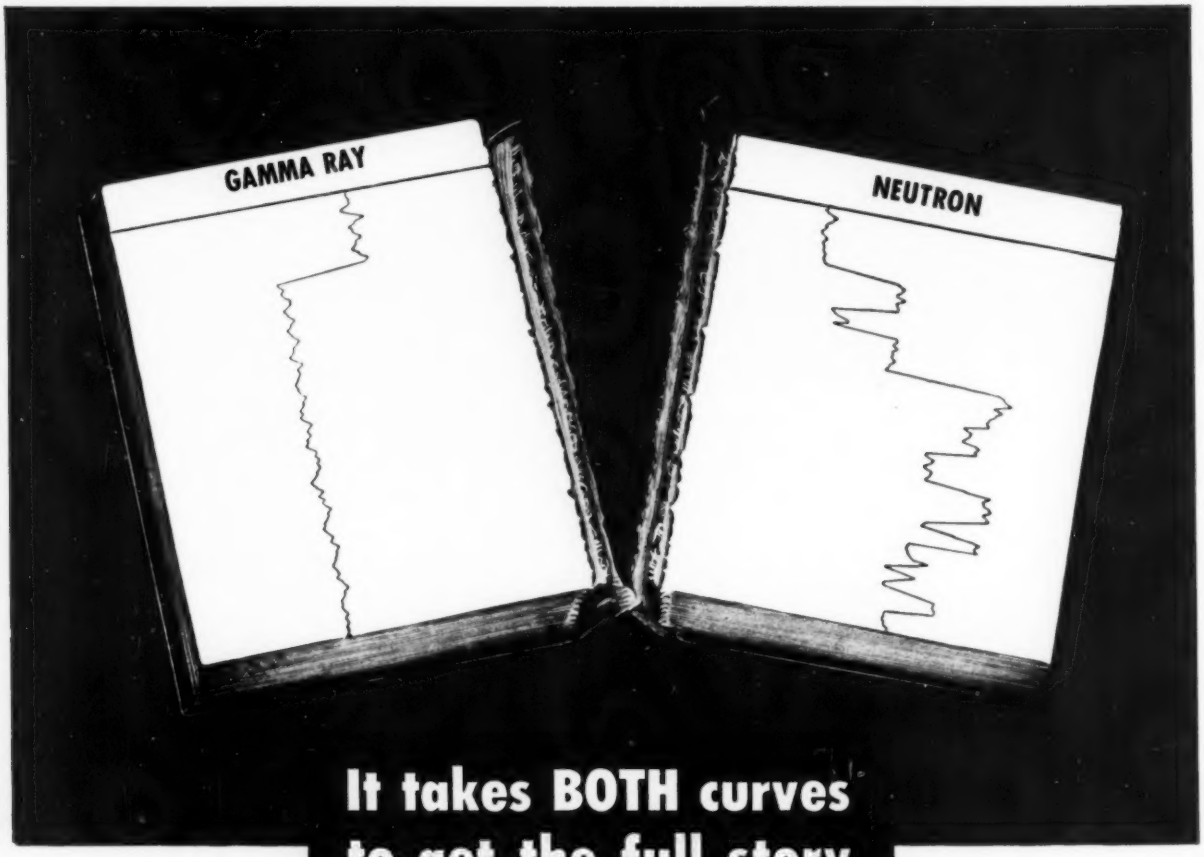
# World Petroleum



FEBRUARY 1952

FIVE DOLLARS PER YEAR
ONE DOLLAR PER COPY




# It takes BOTH curves to get the full story

The Gamma Ray does a great job in charting the formations pierced by the well, there's no denying that. But the Gamma Ray curve is something like the first half of a book — it doesn't tell the whole story. For that, for the last chapters of the book, you need the Neutron curve.

Since the Neutron instrument responds to formation fluids, it supplements and completes the story started by the Gamma Ray (which does *not* show fluid content). As an example, take the not unusual case of a productive sand or limestone formation with impermeable streaks which, in effect, form separate reservoirs. The Gamma Ray curve defines the extent of the whole body, but it takes the Neutron curve to show the location and extent of the impermeable streaks and thus indicate the best possible completion program. The Neutron curve also makes unmistakably clear the difference between certain formations which sometimes record similarly on the Gamma Ray curve.

As if this were not enough, the Neutron curve supplies still further information. Being sensitive both to fluid and to the shielding effects of casing, the Neutron curve is of great value in establishing, accurately, the location of casing seats, liner overlaps and the well's fluid level. So, on your next well logging job, give thought to getting *both* curves — having the complete story pays.

*Tomorrow's Tools – Today!*

LANE WELLS

*Radioactivity*
**WELL LOGGING**

# Unique

"Newallastic" bolts and studs have qualities which are absolutely unique. They have been tested by every known device, and have been proved to be stronger and more resistant to fatigue than bolts or studs made by the usual method.

## C. P. Newall & Co., Ltd.

POSSILPARK GLASGOW · N

**ASK THE AEROFIN MAN**

*For the Practical Answer to Your Heat-Exchange Problem . . .*

**Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.**

There is a competent Aerofin heat-transfer engineer near you, qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem.

This specialized knowledge is there, ready for you to use to your greatest advantage. Ask the Aerofin man — and be right.

AEROFIN CORPORATION
410 South Geddes St., Syracuse 1, N. Y.

WORLD PETROLEUM for February, 1952. Vol. 23, No. 2. February, 1952. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 2 West 45th St., New York 36, N. Y. Acceptance at East Stroudsburg, Pa., under Section 34.64 P. L. & R. Authorized. Subscription rate: $5.00 per year, single copies $1.00. Copyright, 1952 by Mona Palmer, Trustee.

# Why is complete antiknock service very much like a diamond?

Worth-while antiknock service, like a valuable diamond, has many facets . . . each of which must be perfectly formed in itself and properly related to the others.

It is Ethyl's twenty-seven years of experience concentrated in the antiknock field which has made possible the painstaking development of each individual facet.

Ethyl service follows every drop of "Ethyl" antiknock fluid all the way from its manufacture to its ultimate consumption in an engine.

"Ethyl" antiknock compound is mixed with gasoline—so we assist refiners in blending operations, offer a wide variety of technical aids and, through national advertising, help them sell leaded gasoline. Since this gasoline is used in engines, a continuous fuel-engine research program is constantly in progress. Finally, because these engines are used in many types of vehicles—cars, trucks, buses, tractors, airplanes—special Ethyl activities have been developed in each specialized field.

Each of these services is a facet on the Ethyl service diamond—important individually, but whose true worth can be measured only in terms of the entire program.

**ETHYL CORPORATION . . . New York 17, New York**

# Now...Even Simpler Counterweight Adjustment!

Quicker than ever; only two nuts to loosen on the weight assembly of most models.

Note also that one crank position is sufficient for all counterweight adjustments.

Socket wrench is applied here to turn pinion. Action of pinion (geared to rack) shifts the weight to desired point.

When first presenting its Series 50 pumping units, Bethlehem introduced the simplest, easiest, safest counterweight adjustment ever devised for this type of machine. It was a feature that had thoroughly proved itself under many gruelling tests . . . and one that continued to prove itself in the field, where it met with immediate success.

And now—adjustment of the weights has been further simplified by using only two binding bolts per weight on units through the 54-in. stroke, three bolts on units with 64-in. stroke, and four bolts on units with 74-in. and 86-in. stroke. In all cases these bolts are "in line" so that they are even more accessible than on the earlier models.

The operator, after loosening the bolts, merely applies his socket wrench to the end of a pinion shaft. He moves the wrench gently, with little or no effort, and the weight shifts position. Numbered graduations on the crank and an index on each outer counterweight shell, facilitate adjustment.

It's all so effortless and safe! No climbing or scrambling. The operator stays on the ground, and there's nothing than can fall from the unit and hurt him.

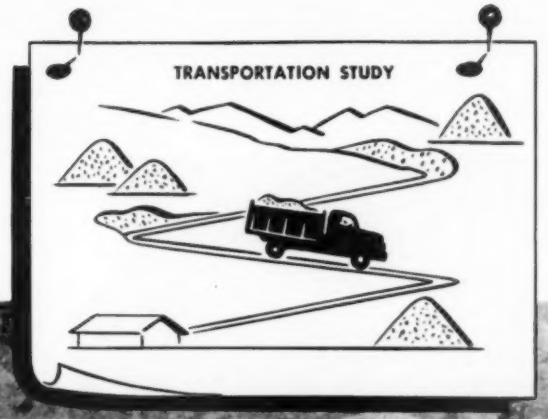
Write us for more detailed information; it will be furnished promptly.

*Bethlehem pumping units are available in many sizes and types, to cover a wide range of pumping conditions.*

*Investigate, too, Bethlehem's complete line of rotary drilling equipment—drawworks, slush pumps, crown and traveling blocks, swivels, and rotary tables.*

**BETHLEHEM STEEL EXPORT CORPORATION**
25 Broadway, New York 4, N. Y., U. S. A.
Cable Address "BETHLEHEM, NEWYORK"

BETHLEHEM STEEL




## Putting ideas into action

Three International Truck series – the L-160, L-170 and L-180 models – are rapidly becoming "performance leaders" where trucks from 14,000 to 21,000 pounds gross vehicle weight are used. Why? More satisfying operation for a greater cross-section of truck owners!

# INTERNATIONAL means "Stamina on the Job"

Because they're Heavy-Duty Engineered to master these tough hauls, International Trucks just can't be beat for stamina on the job! Remember, Heavy-Duty Engineering is found in *every* part of an International, to give you longer truck life and keep operating and maintenance costs down.

What's more, better mileage goes hand in hand with more power in these great International Trucks. That's because all-truck engines are used in every model . . . engines that incorporate the latest advances in design to guarantee a more efficient combination of power, speed and economy.

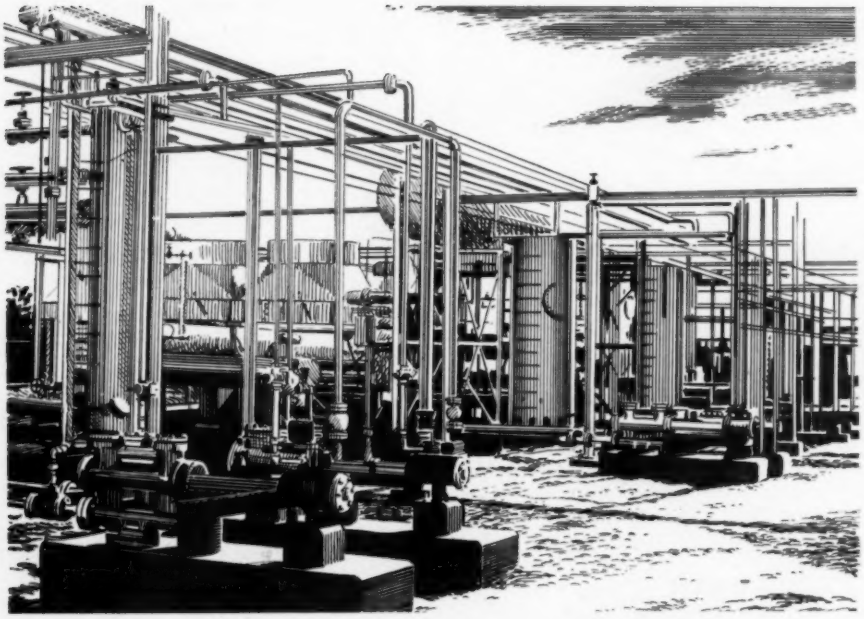
Find out more about these popular trucks from your International Truck distributor. He has full facts on the International model that will stabilize your transport costs. International Harvester Export Company, 180 No. Michigan Avenue, Chicago 1, U.S.A.

*Diesel engines available in L-170 series and larger.*

INTERNATIONAL

# INTERNATIONAL TRUCKS

***Better Living through Better Roads***



## Worthington helps turn petroleum

### into motion for everybody's benefit

All the way from oil well to motor car, railroad engine and industrial machine, Worthington furnishes a host of equipment to lower the costs of petroleum products.

Meanwhile, *profits* are increased for those who produce, refine and distribute the oil—because Worthington offers maximum efficiency in such products as re-pressuring equipment, pipeline and refinery pumps, turbines, Diesel and gas engines, condensers, refrigeration machines for refineries, decoking systems, drive equipment.

Many machines now standard in the petroleum industry were originated by Worthington during its 111-year history and are included in the world's most diversified line.

Write for Bulletin on Worthington Products for the Petroleum Industry to Worthington Pump and Machinery Corporation, Export Department, Harrison, New Jersey, U. S. A.

**WORTHINGTON**

*THE SIGN OF VALUE AROUND THE WORLD*

**WORTHINGTON'S "BIG 3" ENGINEERING SERVICE**

**1. Before you buy** Worthington gives valuable advice in the correct selection of equipment for each specific application. You benefit from Worthington's century of experience.

**2. When you buy** Worthington engineers are available to supervise installation, advise operators and maintenance men and to see that equipment operates properly.

**3. After you buy** Worthington provides competent service—engineering advice on new problems, quick availability of spare parts.

F.1.30

PUMPS CONSTRUCTION EQUIPMENT ENGINES TURBINE-GENERATORS COMPRESSORS REFRIGERATION

## *Oil makes him master of the seas...*

Wherever in the world men and cargo go on the seas, they go with the aid of petroleum. Much of the constant development of petroleum is being accomplished by men who work competitively in a free land. As a result, petroleum progress has helped keep man in control of the seas... helped build international commerce. The Texas Company is proud that its products serve ocean commerce in ports all over the world.

*The Texas Company*

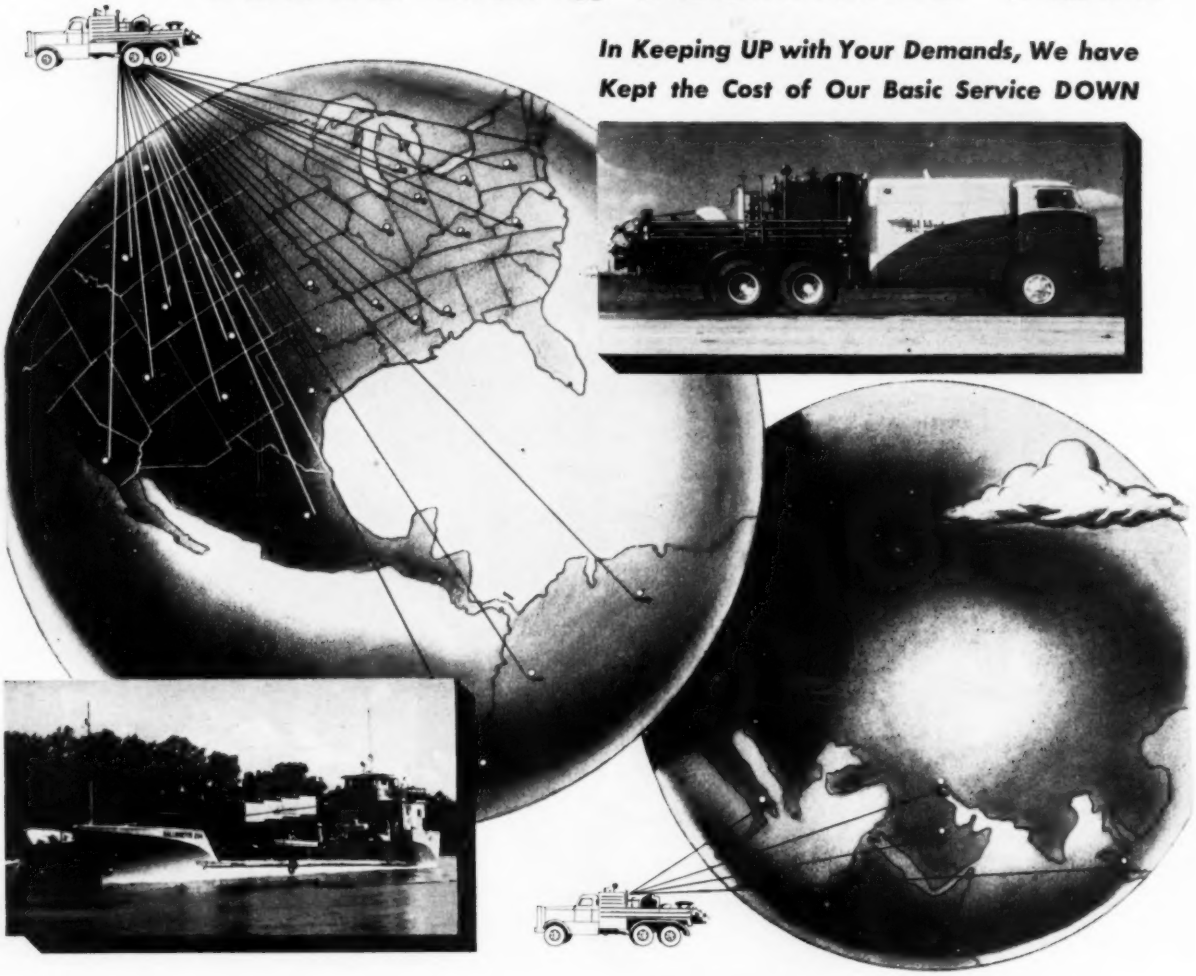
TEXACO

*Faithfully yours* 1902 | *for Fifty Years* 1952

# You've Set a TERRIFIC Pace

***In Keeping UP with Your Demands, We have Kept the Cost of Our Basic Service DOWN***





With the courage of youth we adopted a policy, in our early days, of making Halliburton service available wherever American oil men drilled for oil.

We didn't know at the time that fulfillment of this policy would carry Howco equipment and men to the far corners of the earth, and necessitate the development of marine as well as land cementing facilities.

It has been gratifying to keep pace with the progress of so fast-moving an industry, but still more gratifying to provide expanded cementing services and facilities at a cost that has been kept down while practically all other costs have gone up.

Actually, the price of the average Halliburton cementing job is lower today than it was in 1924!

Erle P. Halliburton

Chairman of the Company

HALLIBURTON OIL WELL CEMENTING CO.

Duncan, Oklahoma

# ALUMINUM

**FABRICATION BY GRAVER**

## EXCELLENCE OF TECHNIQUE REFLECTED IN REPEAT ORDERS

The skillful workmanship and rigid quality controls which produced three Graver-built aluminum bins — specially designed for the process system of a large organic chemical plant — are evidenced by a recent re-order.

This is another example to verify the fact that industries of many types rely on Graver for precision and precaution in alloy fabrications. It also indicates the excellence of Graver workmanship — both in the shop and in the field.

**GRAVER TANK & MFG. CO., INC.**
EAST CHICAGO, INDIANA
NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON
DETROIT • CINCINNATI • CATASAUQUA, PA.
HOUSTON • SAND SPRINGS, OKLA.

Aluminum Bin — 12' dia. x 31'3" long fabricated by Graver for Gulf Coast chemical plant.

# "You may have to stand outside!"

REMEMBER Aesop's fable of the camel and his master--how the kind master allowed the shivering beast to put into the tent first his head, next his shoulders, then his forelegs!

And then the camel said, "Master, I think I ought to come wholly inside," and crowded in. Immediately he said, "There is hardly room for us both, so I think it would be better for you to stand outside so I can turn around and lie down." And without further ado, the camel kicked the man out and took the entire tent.

Men have heard this story for 2,500 years--repeatedly have seen how it illustrates what happens when one man or group of men gain power over others. Men saw it happen in Italy and Germany when Mussolini and Hitler took over. Men saw it happen in Russia.

Even here in America a similar trend is evident. Powerful influences overlook no opportunity, through political manipulation, central controls and bureaucratic regulations, to intrude more and more in our private lives. The situation demands continual, alert watchfulness by all citizens who believe in individual liberty and freedom, to prevent this camel of big government from creeping further into the tent. Before we realize it, "we, the people," the master, may find ourselves "standing outside." In America it is government, which is the servant of the people.

YOUR SCRAP V YOUNGSTOWN IS NEEDED

## The Youngstown Sheet and Tube Company

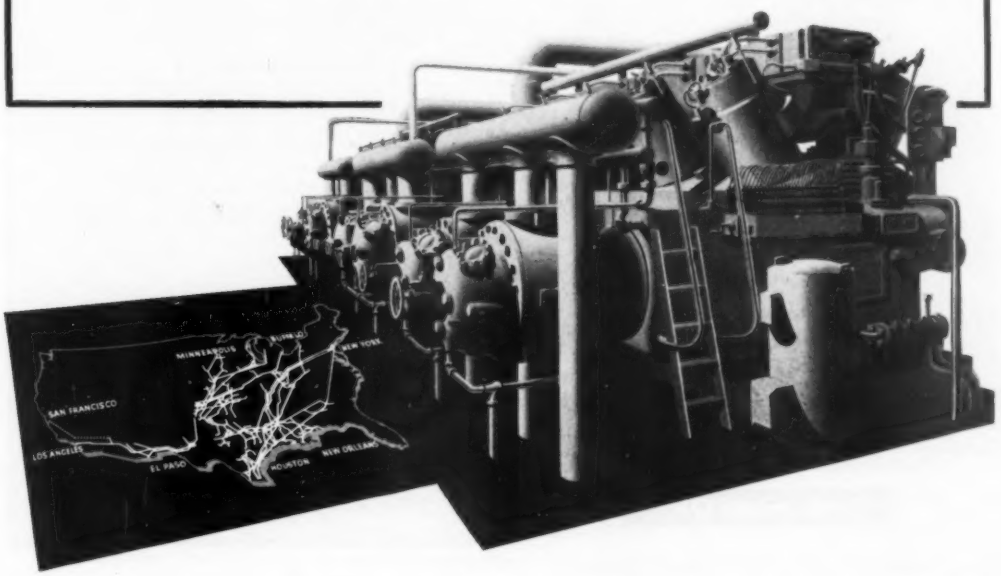
General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

# GULF SECURITY OIL

provides better lubrication
for pipe line compressor units,
helps prevent operating troubles




Here's the lubricant you can depend on to help keep your pumping stations operating smoothly and continuously—Gulf Security Oil. It provides effective protection for cylinders and bearings in both engines and compressors.

Because of its excellent resistance to oxidation, Gulf Security Oil stands up for many hundreds of hours without any appreciable change in its original properties. After years of operation with this quality lubricant, equipment shows remarkable freedom from cylinder wear and a minimum of carbon deposits on valves and rings. And because oil control rings are kept clean, oil consumption is remarkably low.

Operators of the many units lubricated with Gulf Security Oil report that this quality lubricant helps them get more operating hours between overhauls, and avoid unscheduled shutdowns.

For additional information on Gulf Security Oil and for the services of a Gulf Lubrication Engineer, get in touch with your nearest Gulf office today. Write, wire, or phone.

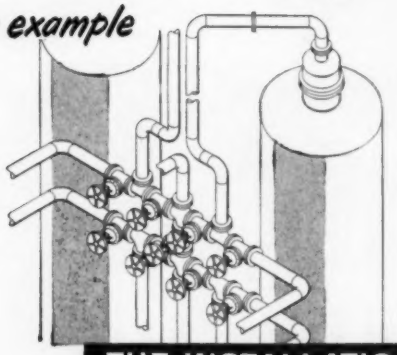
Gulf Oil Corporation · Gulf Refining Company,
Gulf Building, Pittsburgh 30, Pennsylvania.

GULF INDUSTRIAL LUBRICATION

# Are You Getting Valve Satisfaction?

## Like this Refinery

*for example*



**THE INSTALLATION**

Nine Crane valves on control manifold to reaction chambers on Perco Cycloversion Unit. Bareco Oil Company, Wichita, Kansas.

**VALVE SERVICE RATINGS**

| | |
|---|---|
| **SUITABILITY:** | Matches service needs |
| **MAINTENANCE COST:** | None to date |
| **CORROSION-RESISTANCE:** | O.K. |
| **SERVICE LIFE:** | Now more than 2 yrs. |
| **OPERATING RESULTS:** | Valve leakage stopped |
| **PRICE:** | In line |
| **AVAILABILITY:** | Local Crane supplier |

**THE HISTORY**

Valves formerly used would not stay absolutely tight as necessary. Down time for repairs was excessive. Fluids handled: At oil inlet, straight run gasoline at 950 Deg. F., 85 psi; for catalyst regeneration, air-steam mixture at 850 Deg. F., 15 psi; regeneration waste gases, 1200 Deg. F. at 5 psi. Approximately 15-day cyclic operation.

Replacement made with Crane Valves. After more than 2 years' service, with no maintenance required, all Crane Valves are absolutely tight and operating at highest efficiency.

**THE VALVE**

Crane 300-Pound No. 5 Chrome-Molybdenum Alloy Steel Wedge Gate, with Stellite seats and patented flexible disc design. One of the complete Crane steel family for refinery services. See your Crane Catalog or get full data from your Crane Representative.

*The Complete Crane Line Meets All Valve Needs. That's Why,*

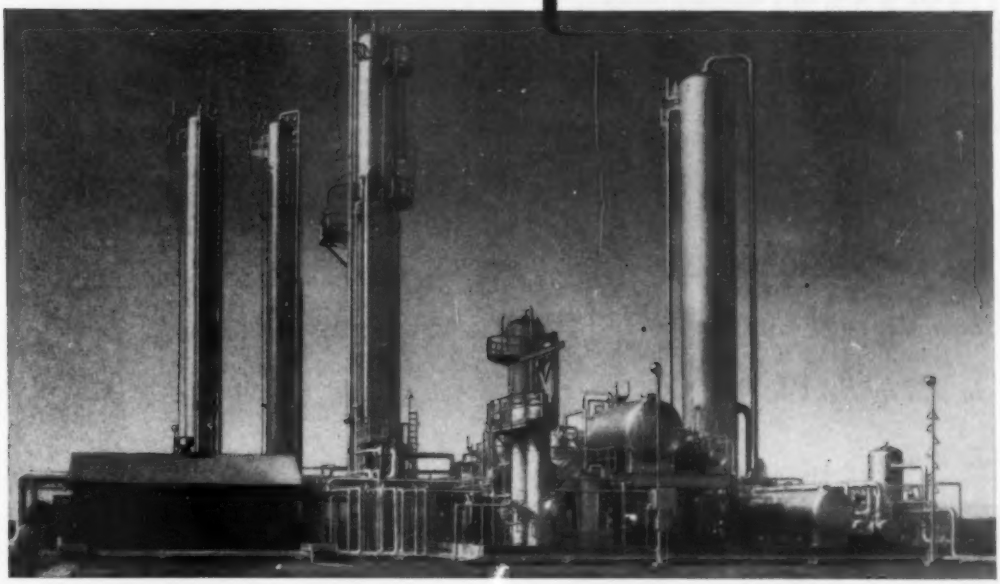
**More Crane Valves Are Used Than Any Other Make!**

# CRANE VALVES

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois, E.U.A.
In Great Britain: Crane Ltd., 45-51 Leman St., London E.1, England
In Canada: Crane Limited, 1170 Beaver Hall Square, Montreal, Quebec

***VALVES • FITTINGS • PIPE • PLUMBING • HEATING***

# COMPACT DESIGN { Means Lower Operating Costs –High Operating Efficiency

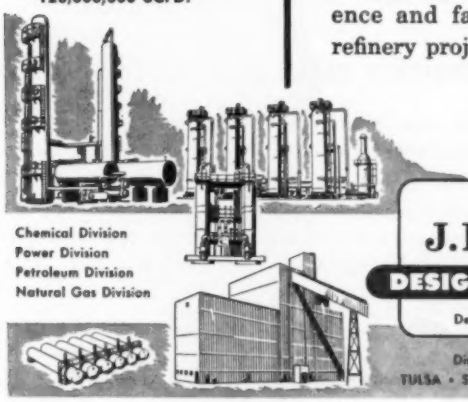


## In Natural Gasoline Plants by Pritchard

The natural gasoline plant, illustrated above, was designed and constructed by Pritchard for Hugoton Plains Gas & Oil Co. It's located astride the Oklahoma-Kansas border, three miles north of Tyrone, Oklahoma, and has a design capacity of 120,000,000 SCFD.

Here is just one example of compactness of design made possible by Pritchard's modern concept of engineering, processing and design...design that means big savings on initial investment and operating costs, *with no loss of capacity or operating efficiency!*

Why not avail yourself of Pritchard's skill, experience and facilities on your next gasoline plant or refinery project?



*We invite your specific inquiry.*

NATIONAL CONSTRUCTORS ASSOCIATION MEMBER

Chemical Division
Power Division
Petroleum Division
Natural Gas Division

**J.F. Pritchard & Co.**

**DESIGN • ENGINEERING • CONSTRUCTION**

Dept. No. 260 — 908 Grand Ave., Kansas City 6, Mo.

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TULSA • ST. LOUIS • Representatives in Principal Cities from Coast to Coast

# Safety comes first IN REFINERIES

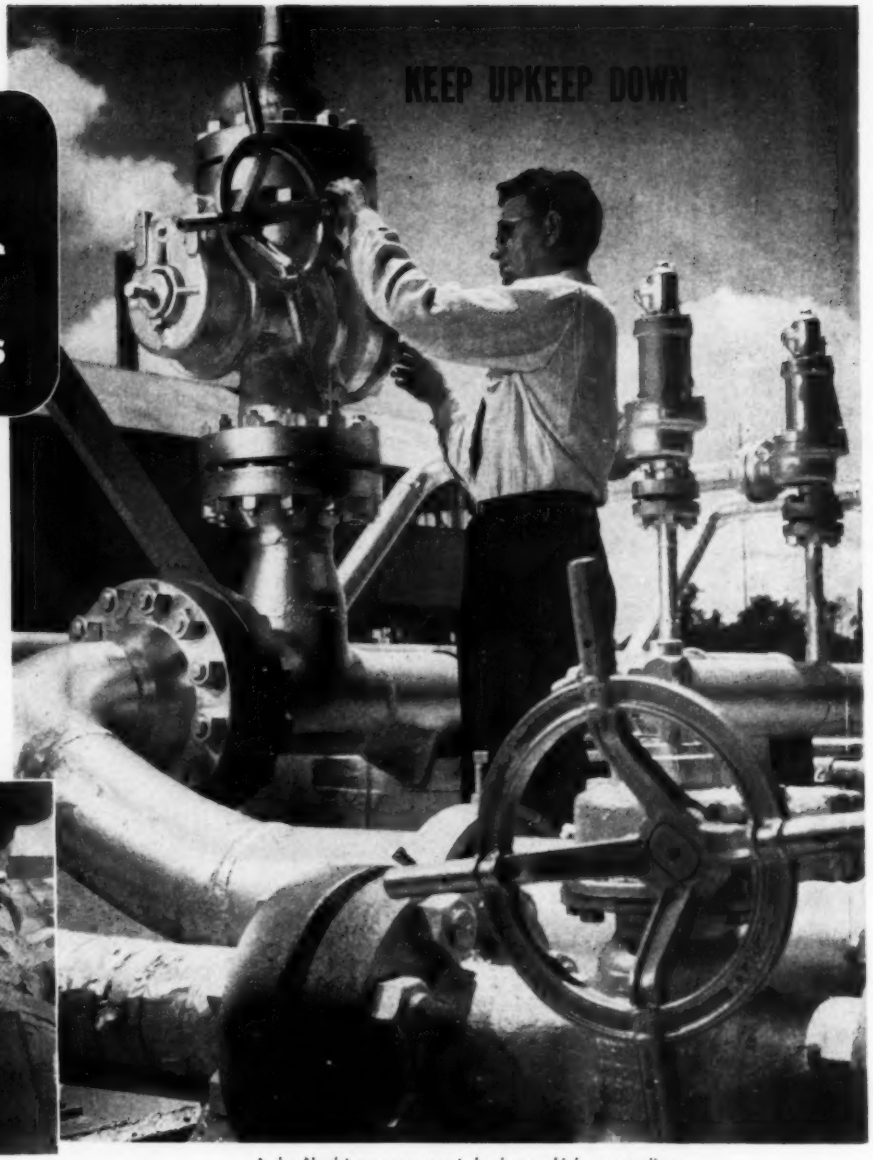
**SAFETY** *in high pressures*

**SAFETY** *in high temperatures*

**SAFETY** *in closing*

**SAFETY** *in sealing tight*

**SAFETY** *in design*




Audco-Nordstrom gear operated valves on high pressure lines

Audco-Nordstrom valve on extreme temperature line

## PRODUCT HANDLING IS INFINITELY SAFER WITH AUDCO-NORDSTROMS

In handling petroleum products you first consider *safety*. That calls for ever-tight valves, free from freezing, free to turn easily, positively sealed around the ports regardless of line pressure. The Audco-Nordstrom design fits these specifications perfectly. The tapered plug is pressure lubricated, held tight on its unexposed seat by resilient means: the lubricated seat permits easy rotary turning of the plug, as contrasted to metal-to-metal unlubricated seats in common types. Pressurized lubrication surrounds each port to prevent leakage: the plug can be hydraulically jacked when required. For handling gasoline, distillates, butane, propane and other petroleum products, Audco-Nordstroms have no equal. Ask for descriptive literature.

BRITISH AMERICAN

# Audco-Nordstrom

## LUBRICATED VALVES

**ROCKWELL MANUFACTURING COMPANY**
400 N. Lexington Ave., Pittsburgh 8, Pa.
Export: International Division, Rockwell Manufacturing Co., 7701 Empire State Bldg., New York 1, N. Y. Canadian Licensees: Peacock Bros., Montreal, Quebec.

**AUDLEY ENGINEERING COMPANY, LTD.**
Newport, Shropshire, England
Overseas Agents located in South Africa, Australia, India, Trinidad, British West Africa, Finland, Norway, Sweden, France, Belgium, Switzerland, Italy, Roumania, Spain and Portugal.

# Carbometals LTD

*—manufacturers of*

## *FISH-TAIL & DRAG BITS for exploration and production drilling*

*

Designed for drilling in exceptionally hard and abrasive formations.

All 'Carbometal' Bits are hard-faced with a special grade of Titanium Carbide which ensures prolonged service life.

Users report that these bits have been used with outstanding success through formations where, formerly, roller-type bits had to be used.

*

***Carbometals Ltd. also manufacture:***

**TITANIUM CARBIDE HARD-FACING ELECTRODES**

**DRILLING AND CORING CROWNS**

**INSERTS FOR CROSS-TYPE AND CHISEL-TYPE PERCUSSION DRILLS**

**DIAMOND-IMPREGNATED CROWNS**

*Please direct all enquiries to:*

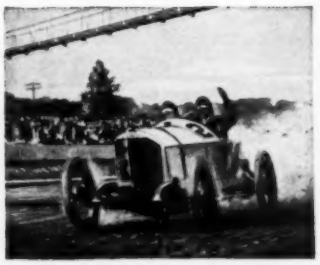
**Carbometals Ltd.** Aquila Street, London, N. W. 8, England

*Telephone:* Primrose 2265 *Cables: Carbometal, London*

# Keeping Pace with the Pace Setters—

***Flying Red Horse Products Are Continually Improved to Match Progress on Land, Sea and in the Air!***

**SOCONY-VACUUM**



**1915**—Ralph DePalma wins Indianapolis Speedway Race with average speed of 89.84 m.p.h. Credits great performance of his car to engine protection provided by Mobiloil!

•

**1951**—Lee Wallard averages record-smashing 126.244 m.p.h. to take 500-mile Indianapolis Classic. For almost 4 hours his engine raced at top speed—guarded by heavy-duty Mobiloil!

**1910**—R.M.S. *Mauretania* captures Blue Ribbon honors by crossing Atlantic in 4 days, 10 hrs., 41 min. Gargoyle Marine Lubricants protected her turbines, auxiliary machinery!

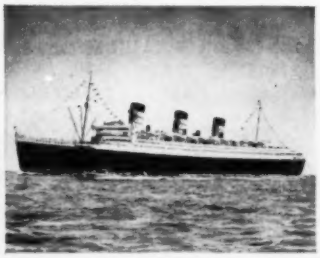
•

**1952**—The *Queen Mary* holds present transatlantic speed record of 3 days, 20 hrs., 42 min. Like every Atlantic Blue Ribbon winner since 1910, she is protected 100% with Gargoyle products.

**1933**—Wiley Post makes history's first solo flight around the world—time: 7 days, 18 hrs., 49½ min. To assure dependable, full-powered engine operation, Post used Mobiloil Aero!

•

**1952**—Pan American World Airways' global flights take 3 days, 21 hrs., 40 min. actual flying time. Their record of dependability has been set with aid of Mobiloil Aero!



**SOCONY-VACUUM OIL CO., INC.** and Affiliates: MAGNOLIA PETROLEUM CO. GENERAL PETROLEUM CORP.

# What more can we say?

Bill Duke, drilling superintendent for Lohmann-Johnson Drilling Company, watching a string of REED Super Shrink-Grip Tool Joints being applied at Plainville, Kansas.

LOHMANN-JOHNSON DRILLING CO., INC.
320 AMERICAN BUILDING
EVANSVILLE 8, INDIANA

May 17, 1951

Reed Roller Bit Company
P. O. Box 2119
Houston 1, Texas

Gentlemen:

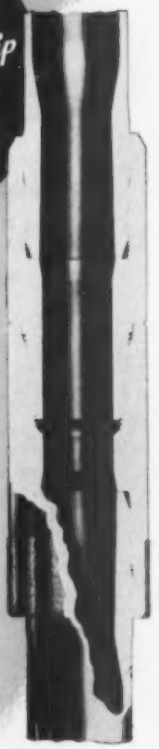
In answer to your question as to why we use Reed Super Shrink-Grip Tool Joints exclusively, I find there are at least four reasons which I will list:

1. Field replacement of tool joints saves us transportation costs and down-time.
2. We get longer service from drill pipe by reversing ends when replacing tool joints.
3. Your practice of pre-lubricating tool joint threads prevents galling.
4. We have never had a washout, thread failure, or other undue trouble from Reed Super Shrink-Grip Tool Joints.

All these reasons add up to the fact that your tool joints help us keep down drill string costs. That is why we use them.

Sincerely,
LOHMANN-JOHNSON DRILLING CO.
Bill Duke
William Duke
Drilling Superintendent

REED Super Shrink-Grip TOOL JOINTS



**Keep down drill string costs with REED Super Shrink-Grip Tool Joints**

# REED ROLLER BIT COMPANY

HOUSTON 1, TEXAS

NEW YORK · LONDON · BUENOS AIRES

2525

Gulf Coast, Mid-Continent, Rocky Mountain and Canadian Distributor for Martin-Decker Products

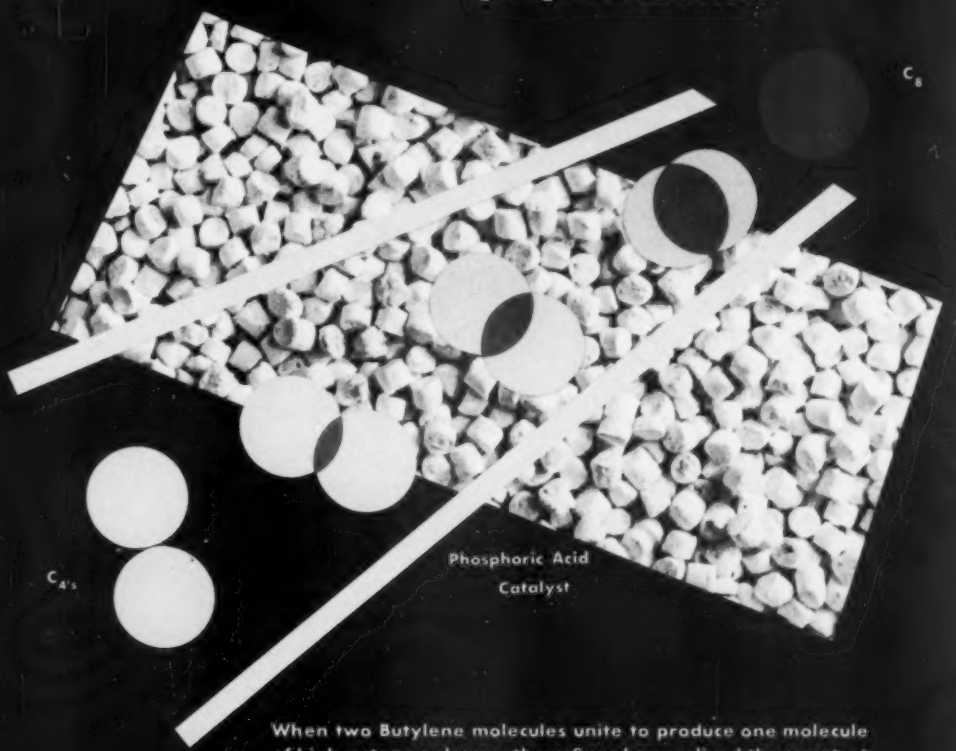
*"Considering the responsibilities now visible on our industry's horizons, we realize oilmen must continue to play an extremely important part in the constructive development of our world. The future is calling for leadership inspired by the kind of democratic principles which have shaped the oil industry. As an oilman, I am proud of our past record and look forward eagerly to the opportunity of even greater service to the world."*

*From a speech by Eugene Holman, President, Standard Oil Company (New Jersey)*

**STANDARD OIL COMPANY (NEW JERSEY)**

**AND AFFILIATED COMPANIES**

# catalytic polymerization



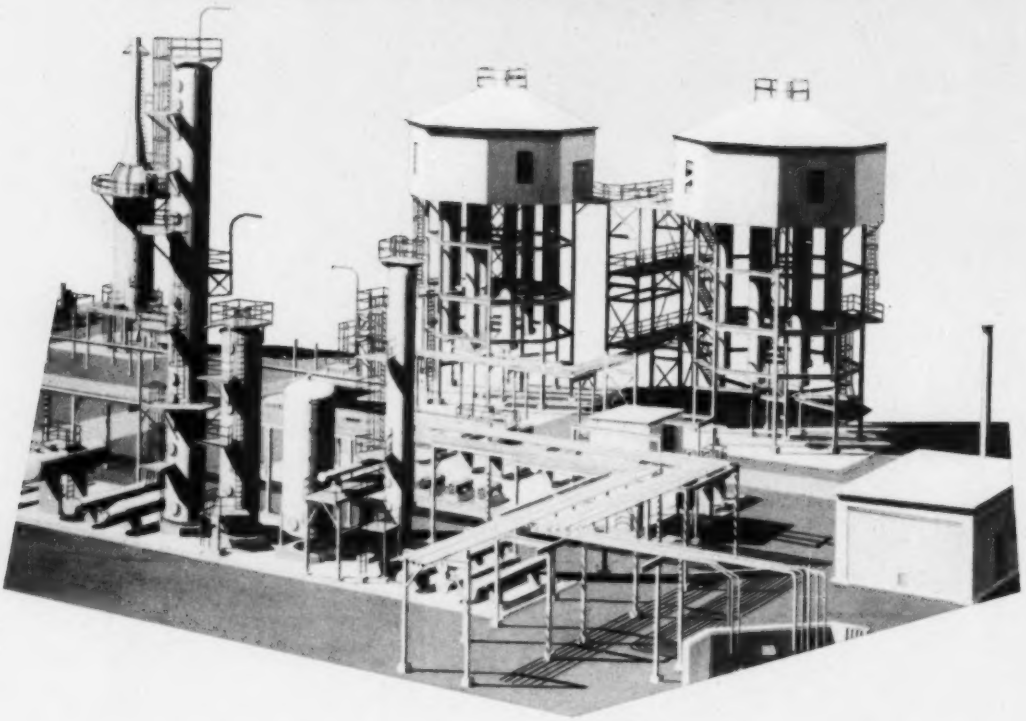

When two Butylene molecules unite to produce one molecule of high-octane polymer, the refiner has realized the greatest increase in product value in petroleum refining.

Foster Wheeler's extensive experience in designing and constructing many of the industry's largest catalytic polymerization, alkylation and isomerization units is available to refiners—anywhere in the world.

FOSTER WHEELER CORPORATION

165 BROADWAY NEW YORK 6 NEW YORK

## 4000 barrels of polymer per day



This catalytic polymerization unit, . . . .

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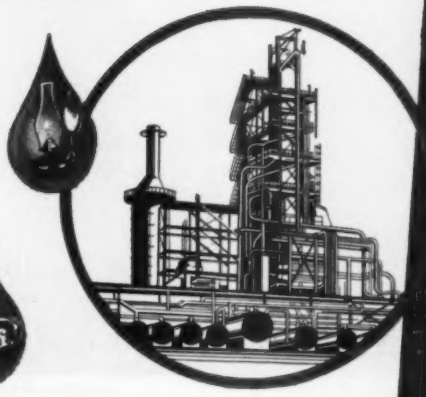

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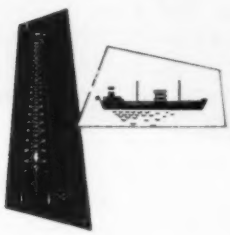

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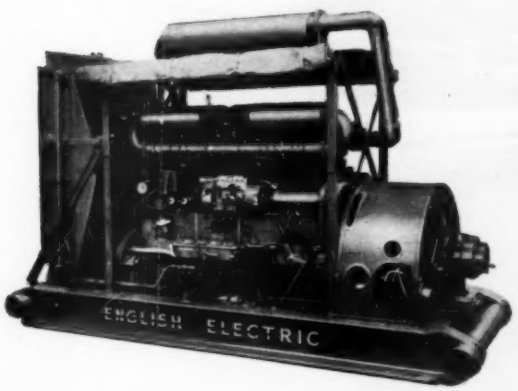


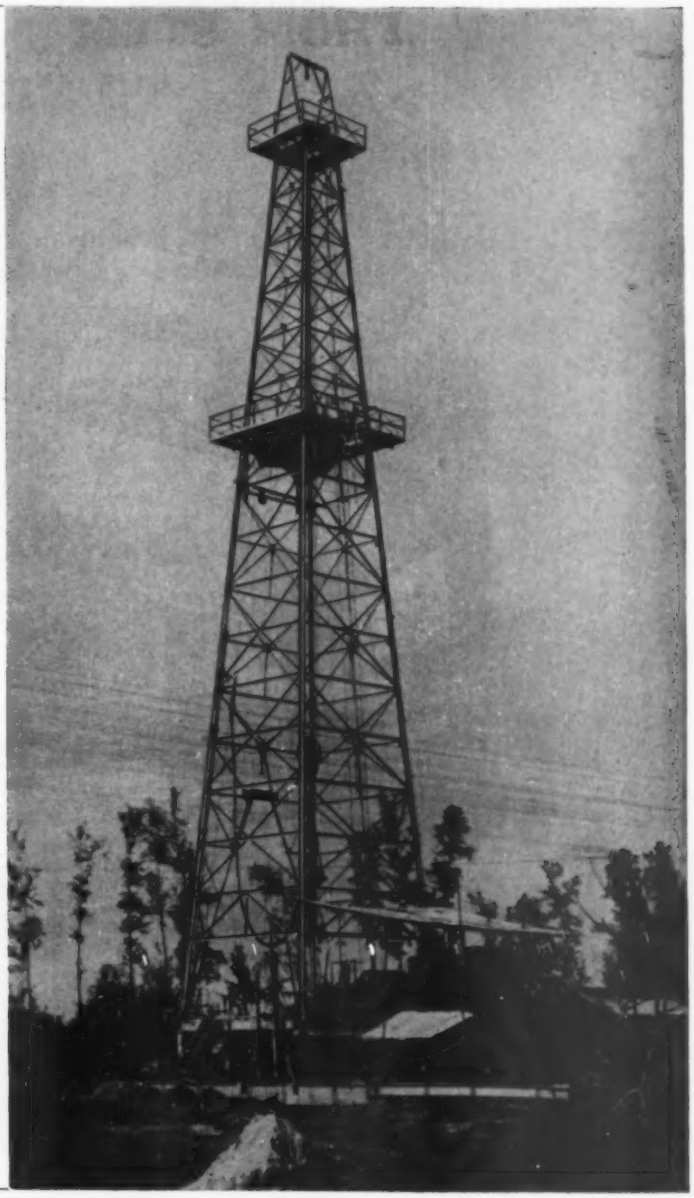

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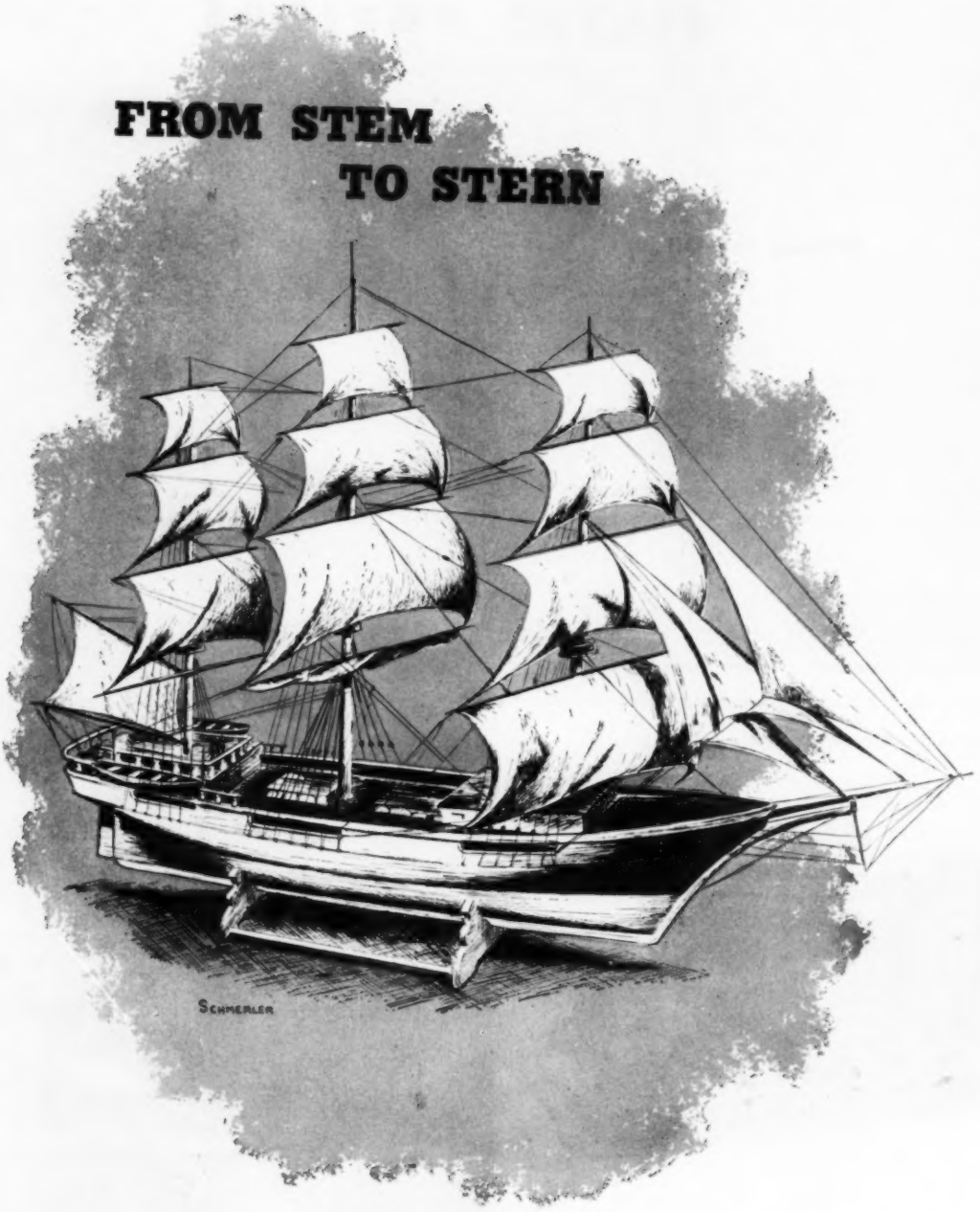
# FROM STEM TO STERN



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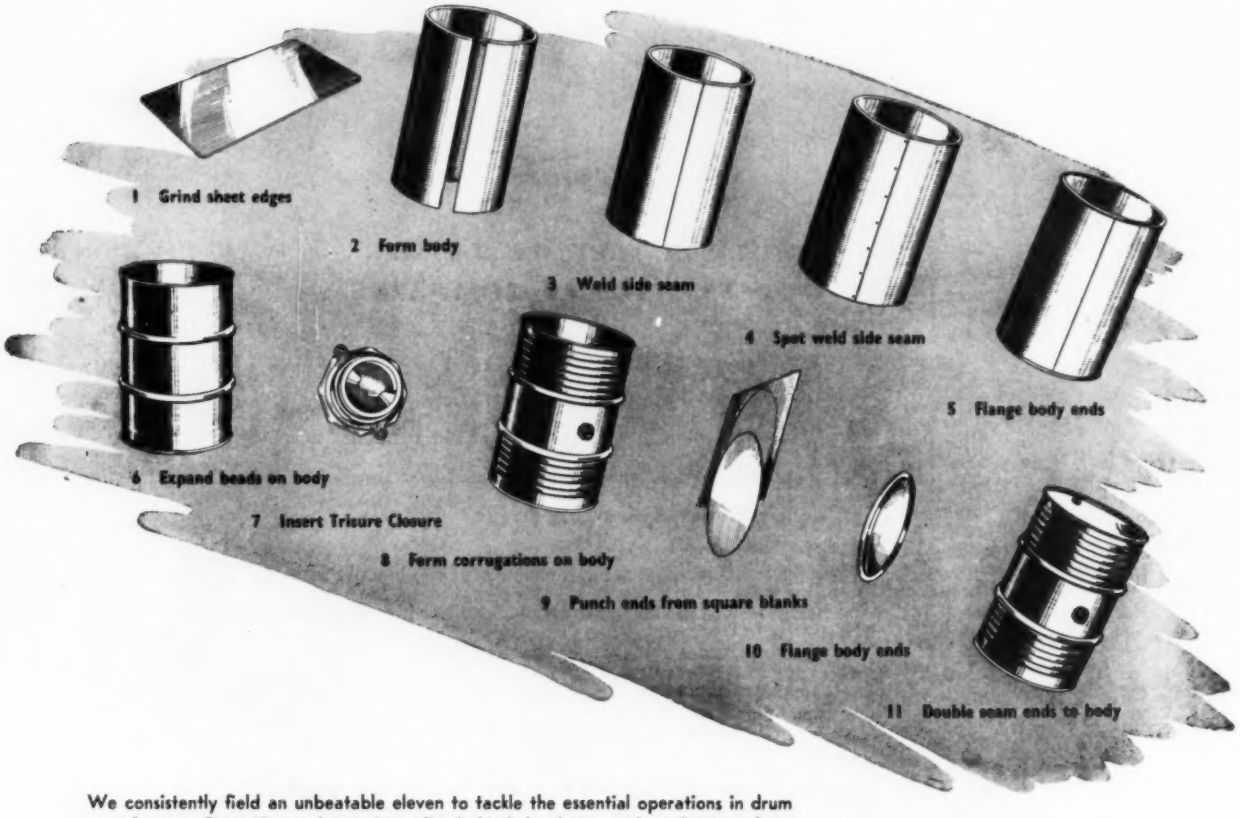
1 Grind sheet edges
2 Form body
3 Weld side seam
4 Spot weld side seam
5 Flange body ends
6 Expand beads on body
7 Insert Trisure Closure
8 Form corrugations on body
9 Punch ends from square blanks
10 Flange body ends
11 Double seam ends to body

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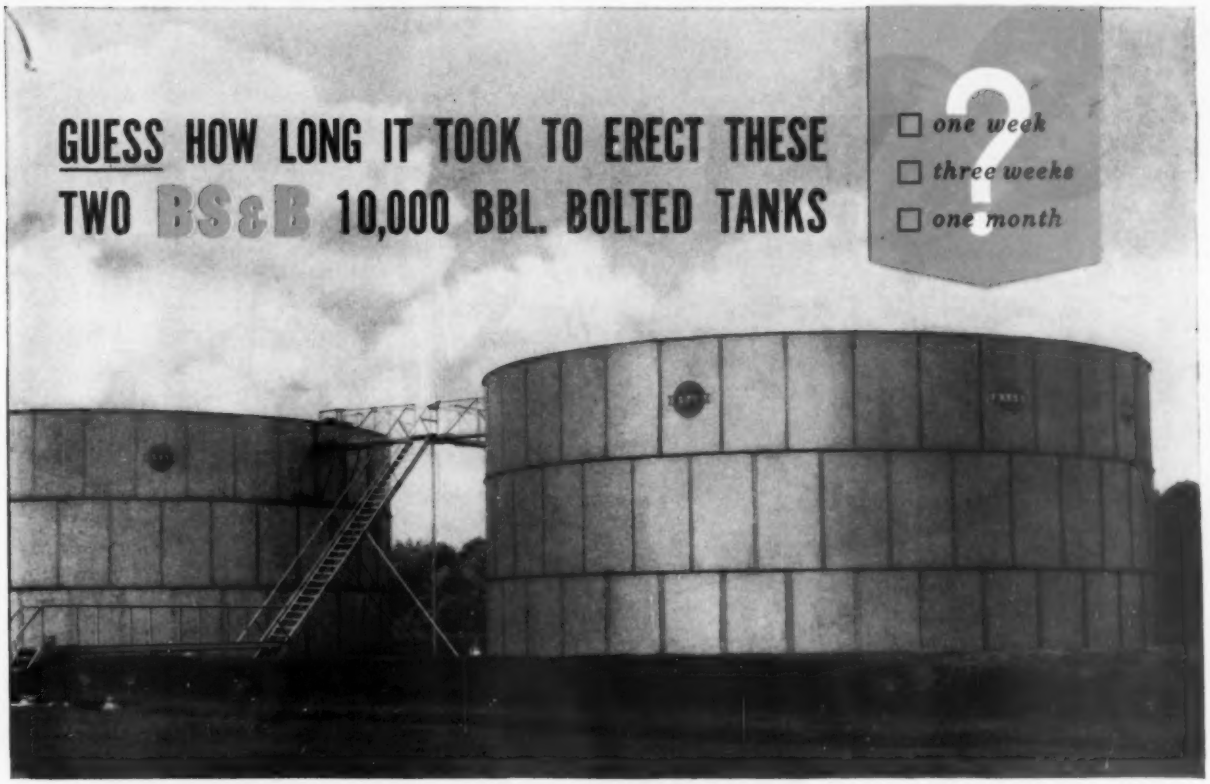


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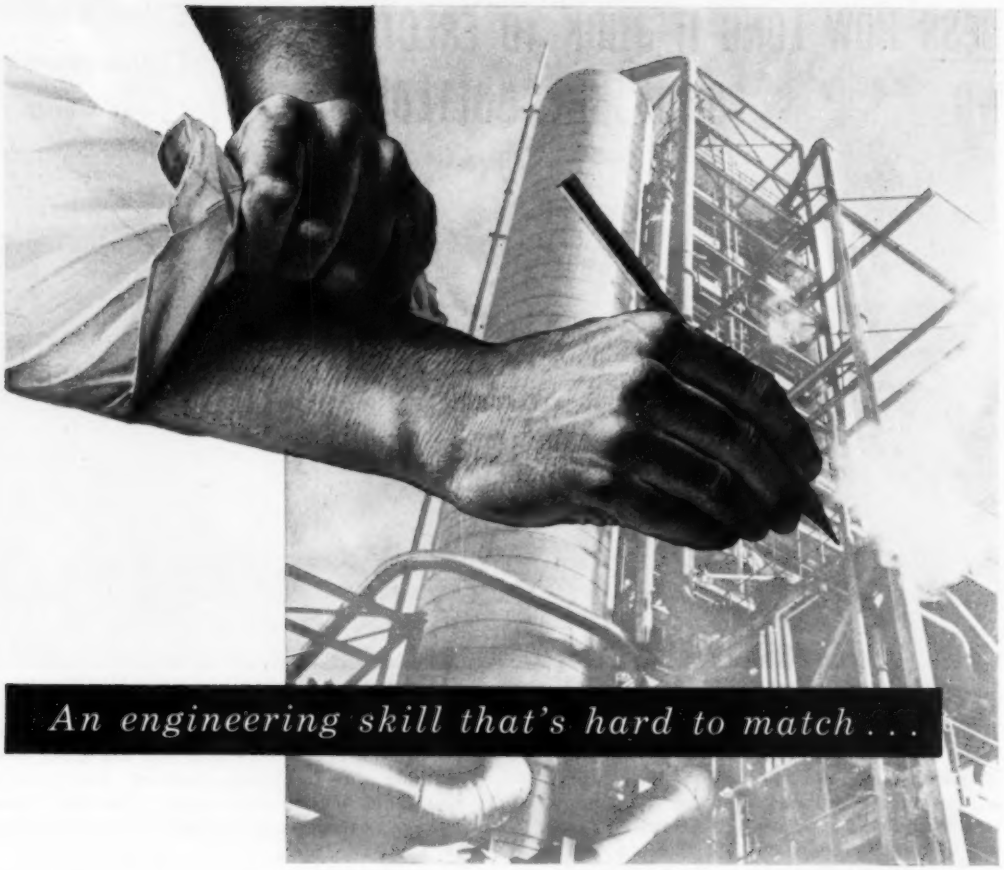

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THIS MONTH'S COVER

Gasoline from the Augusta, Kansas, refinery of Socony-Vacuum Oil Co. is pumped to five terminals in the middle west, as far north as Sioux Falls, S. D. To reduce corrosion, the 5,500,000 barrels handled each year is given a final dehydration before it leaves the refinery. The color photograph by Jack Tanner shows Engineer Chester Powers and Maurice Hammon operating valves at the dehydrator. Color plates are reproduced through the courtesy of John P. Tolbert, managing editor of *The Flying Red Horse*, Socony Vacuum house magazine.

# RUGGED AND READY TO ROLL

Both men and equipment have to be rugged to roll out more than *five million miles a month*. That's how far Halliburton goes in its service to the oil industry. Halliburton's present automotive fleet numbers nearly four thousand vehicles, ranging from sturdy little pick-ups to huge, heavy-duty super cementers. In addition, Halliburton has five airplanes, five converted LCT's and several barges in regular service. "We'll get there somehow—safely." Behind the wheel of each Halliburton truck is a skilled and experienced representative ready twenty-four hours a day, seven days a week, to perform the high quality of service that has made Halliburton the leader in its field. You'll find it's a good habit to call Halliburton.

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# Oil Industry Enters Year of High Activity

IN 1951 the world oil industry was called upon for a special effort to increase production. Besides being asked to meet a rising tempo of growth which had required an expansion of a million barrels a day in the preceding year, it faced additional demands for its products imposed by the program of the western nations for rebuilding their defenses. Not only did it accomplish this, but it met and filled a deficit of 680,000 barrels per day created in the second quarter when Persian oil disappeared from the international market. For the year as a whole, the average daily supply was 1,200,000 higher than the average for 1950 despite the defection of Iran, and it was about 300,000 barrels above current consumption. In spite of irregularities and the need for a larger output of products, the industry as a whole has entered 1952 in what it considers a more comfortable position than it occupied a twelvemonth earlier. The question of deep interest to members of the industry, however, is what 1952 itself will bring forth in the way of divergencies from the course held during the past few years.

Among those who study trends in the industry, and endeavor, on the basis of such study, to calculate probable changes in requirements for a year or a few years ahead, there has been a frequent assumption that the hard pace set by the expansion of demand for the past two years will show some abatement. This is based in part upon the existence of larger visible and invisible stocks at the turn of the year and upon the fact that the increased demand in the third and fourth quarters of 1951 over the corresponding periods of the preceding year was somewhat less percentagewise than it had been in the first half of the year. In part it rests upon other considerations, such as a belief that demands arising from rearmament may be less than expected due to a slowing down in the progress of defense preparations or that consumption of motor gasoline may be held down by cutbacks in the production of motor vehicles.

Alarmists sometimes draw a vivid picture of the disastrous results that might follow a sudden return of Iranian fields to full production, submerging world markets in a glut of oil. No such event is likely. Even if an agreement to resume activity in Iran could be reached, it would be a long time before the industry could be brought back to its former dimensions. Even a partial restoration would require extensive rehabilitation.

Among those who foresee some modification in the growth rate of oil demand no radical change is anticipated. The Bureau of Mines, usually conservative in its forecasts, estimates demand in the United States for the first quarter of this year at 8,140,000 barrels daily, an increase of 5.2 percent over the first three months of 1951. For the year it puts the probable rise at 7.1 percent. Statistics for early January show an actual rise of roundly six percent over 1951. Some individual forecasters estimate the world increase in 1952 at eight and nine percent. The latter figure would involve lifting daily production above 13,000,000 barrels.

Among those who are charged with responsibility for an adequate defense system rather than the satisfaction of day to day demand, a different view prevails. In these quarters great concern was felt last summer when the shutdown of the Abadan refinery forced an expansion of American production and exports that reduced reserve productive capacity to an estimated 250,000 barrels. These officials consider reserve productivity of a million barrels or more as the minimum insurance needed against a possible sudden emergency. They regard as essential requirements for 1952 the drilling of 45,000 wells within the United States and a 50 percent increase in drilling by American companies operating in outside areas, raising the latter figure to 5,400. Since exploration and drilling show no sign of serious lessening in the United States and is even more active proportionally in other parts of the world, there is no reason to anticipate a lack of adequate production by normal standards.

In other branches of the industry there is full agreement on the necessity of expanding existing facilities as rapidly as the supply of materials and equipment will permit. The estimates of the Petroleum Administration for Defense contemplate the addition of over two million barrels to pipe line capacity in the United States and abroad and a rise of roundly half a million barrels in the daily charging capacity of refineries. Projects already under way or planned give definite assurance that these requirements will be met.

By H. J. Struth
Petroleum Consultant, Dallas, Texas.

# VENEZUELA HOLDS KEY TO NEEDED OIL SUPPLIES

Drawing of Simon Bolivar, father of the Republic of Venezuela, courtesy of El Farol, house magazine of Creole Petroleum Corp.

VENEZUELA undoubtedly will be called upon to play an increasingly important role as a dependable source of oil for the Western Hemisphere during the next five years. This conclusion is supported by a detailed study of world oil supply and demand trends through the year 1956. Under normal conditions, barring another world war, the outlook points to an increase of at least 27 percent in the world's oil requirements by 1956, and a definite need for expansion of Venezuelan supplies.

A paramount consideration in the oil supply outlook over the next five years involves the question of how much more Venezuela can expand her available supply. In 1951, the exportable oil supply amounted to about 1,617,000 barrels daily, 65 percent of which was needed to meet requirements in North and South America. Projections of demand in the Western Hemisphere indicate that by 1956 this area will need at least 11,500,000 barrels of oil daily. This will raise the supply requirements in Venezuela to a relative minimum of 2,200,000 barrels daily. With a total supply in 1951 of about 1,712,000 barrels daily, this means an increase over the next five years of nearly 500,000 barrels daily.

***Mr. Struth has served the Venezuelan government as petroleum consultant over a period of nearly two years. His first-hand studies of the economics of the petroleum industry in that country and his authorship of the first Anuario Petrolero de Venezuela lend weight to the facts and conclusions he presents herein. This is the first in a series of three articles on Venezuela written exclusively for WORLD PETROLEUM.***

The key to greater oil supplies from this source, however, is in the hands of the Venezuelan government. That key is the granting of more concessions, not only to present operating companies, but to others who anxiously await the decision to open more lands for oil exploration and development. Oil production in Venezuela has been stepped up in the last two years to the tune of about 385,000 barrels daily, but the new high level of more than 1,700,000 barrels daily is very close to maximum efficient limits. Discussion of this situation with authorities in both oil industry and government circles leaves no doubt but that the available supply must be increased to meet growing market requirements over the next five years. To do so, however, it will be urgent for the government to make available new sources of supply by granting new concessions.

Preliminary data indicate that the world demand for oil in 1951 averaged about 12,103,000 barrels daily. This comprised an increase over 1950 of about 10 percent. Despite the shutdown in Iran, the world's oil supply ex-

ceeded demand by some 322,000 barrels daily. In the light of the heavy demand expected in the first quarter of 1952, this surplus is not considered abnormal. A fact that serves to intensify the spotlight on Venezuela is revealed by the irrefutable evidence that the Western Hemisphere necessarily depends upon its surplus supply to meet growing market requirements for petroleum and its products.

Although the supply in North America and in other South American countries was increased in 1951 by some 880,000 barrels daily, the domestic demand in these areas exceeded the combined domestic supply by some 1,048,000 barrels daily. This combined shortage comprised 65 percent of Venezuela's 1951 surplus supply. This does not take into account the export requirements of North America. United States exports alone averaged about 400,000 barrels daily.

Analysis of current and prospective demand in the Eastern Hemisphere emphasizes the growing dependence placed upon the Middle East for oil supplies needed to meet domestic deficiencies. In fact, preliminary studies of 1951 data indicate that Europe, Russia and the Far East had a combined deficiency in domestic supply of some 1,670,000 barrels daily, and that the surplus supplies available in the Middle East failed to meet those requirements by some 243,000 barrels daily. While Iran remains an uncertain factor in the future supply picture, it is still possible and necessary to consider the prospective growth in demand for Middle East oil during the next five years.

Projections of oil demand trends through 1956, five years hence, call for a combined increase in the world's suply of about 3,265,000 barrels daily. The Western Hemisphere will need 2,430,000 barrels more a day than was produced in 1951; the Eastern Hemisphere will need 835,000 barrels more a day Despite foreseeable increases in supply in the United States, Canada, and Mexico, the Western Hemisphere undoubtedly will need more oil from Venezuela, and the Eastern Hemisphere will continue to place greater dependence upon oil supplies from the Middle East.

World demand probably will be seven percent greater this year than in 1951, and will continue to rise at a decreasing rate through 1956, when demand may show an annual increase of from 3½ to 4 percent. Between January 1, 1952 and December 31, 1956, it is not unlikely that the cumulative demand will register an increase over 1951 of some 27 percent. To meet relative domestic requirements by 1956, North America alone will have to increase domestic supplies by some 2,075,000 barrels daily above the level established in 1951.

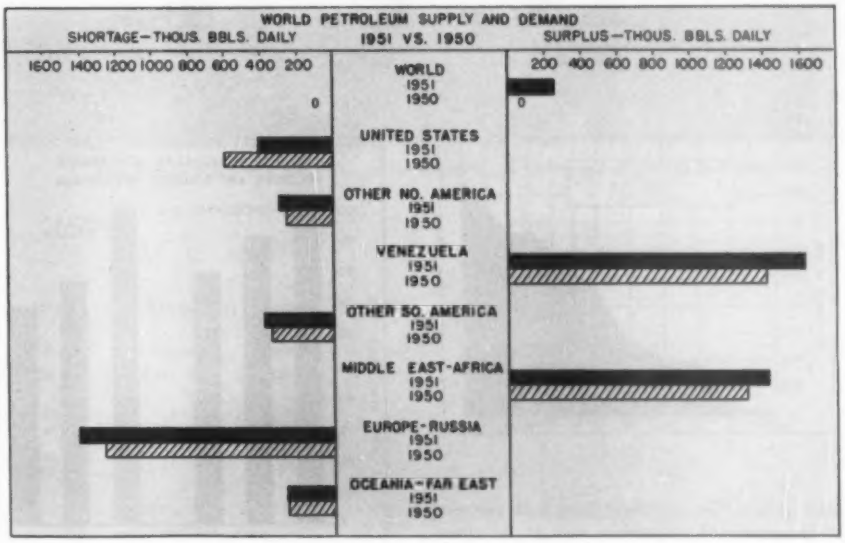
Developments in the United States, Canada, and Mexico appear to offer definite possibilities of substantial increases in domestic oil supplies during the next five years. Much depends, however, upon the extent to which exploratory and development drilling are increased. If steel is available, the industry cannot afford to relax its efforts to find and develop new sources of oil supply. In the United States, for example, this may mean drilling at least 50,000 wells a year, and may involve expenditures of perhaps $17 billion during the next five years.

Factors which must be given immediate recognition are the current productive capacities of both the United States and Venezuela. Recent studies show that the margin between production and maximum efficient rates in the United States is only about 500,000 barrels daily. In Venezuela, the margin is now practically nil. With the demand outlook in the Western Hemisphere 27 percent greater five years hence, it is obvious that there can be no let-up in the search for and the development of new sources of oil supply.

The world is now producing about 4½ percent of its known reserves annually. In 1951, the United States produced 8½ percent of its reserves; Venezuela produced 7.1 percent; other North American areas produced 4.2 percent; the Middle East produced only 1½ percent; and the rest of the world used about 6.1 percent. Ratios of the United States are above normal limits and emphasize the need for more drilling and exploration; Venezuelan ratios imply a similar need, which can only be fulfilled through the granting of additional concessions. Security in the Western Hemisphere, in the event of another world war, demands prompt action in the United States and in Venezuela to promote an adequate build-up in reserves and productive crude oil capacity. Normal demand trends over the next five years are indicative of the need for such action.

While there are many "ifs" in the supply picture over the next five years, there is definite assurance that oil operators in the United States and Canada will continue to expand their productive facilities in response to the prospective growth in demand. Yet, even if anticipated developments in North America in the next five years bring about an increase in domestic supplies on the order of 2,075,000 barrels daily, and the demand rises to say 9,850,000 barrels daily, there would still be a probable shortage of some 719,000 barrels daily. This does not include any allowance for exports. Add to this a continuing deficiency in South America, outside of Venezuela, of perhaps 475,000 barrels daily, and it is not unreasonable to expect a combined shortage in domestic supply of perhaps 1,195,000 barrels daily. This re-emphasizes the importance of Venezuela as a continuing and highly important source of oil supply in the Western Hemisphere.

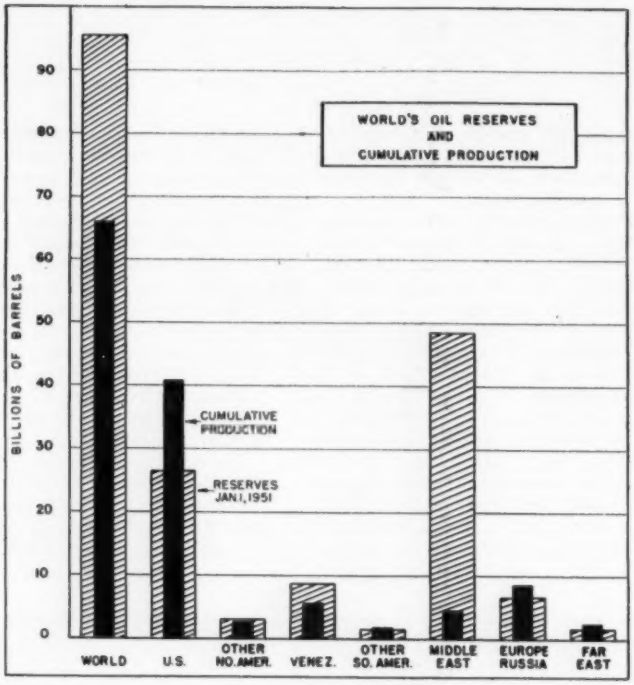
The need for greater exploratory effort in Venezuela is emphasized by the fact that since 1947, reserves in that country have increased about 26 percent while crude oil production rose 53 percent. Estimates place the nation's crude oil reserves at the close of 1951 at about 9,100,000,000 barrels. The ratio of reserves to cumulative production at the close of 1951 was about 1.47 to 1, whereas in 1947 the ratio was 1.81 to 1. The declining ratio of reserves to production undoubtedly has been influenced by a sharp drop in acreage concessions held by operating companies and a decline in drilling operations.


WORLD PETROLEUM SUPPLY AND DEMAND
SHORTAGE—THOUS. BBLS. DAILY
1951 VS. 1950
SURPLUS—THOUS. BBLS. DAILY
1600 1400 1200 1000 800 600 400 200 0
200 400 600 800 1000 1200 1400 1600 0
WORLD 1951 1950
UNITED STATES 1951 1950
OTHER NO. AMERICA 1951 1950
VENEZUELA 1951 1950
OTHER SO. AMERICA 1951 1950
MIDDLE EAST-AFRICA 1951 1950
EUROPE-RUSSIA 1951 1950
OCEANIA-FAR EAST 1951 1950

Since 1948, concession holdings have shown a decline of 20 percent, while drilling operations during the same period were over 31 percent lower. The figures tell their own story:

| | Acres In Concessions | Per-Cent | Total Wells Drilled | Per-Cent |
|---|---|---|---|---|
| 1948 | 19,791,591 | 100.0 | 886 | 100.0 |
| 1949 | 18,053,907 | 91.5 | 682 | 77.0 |
| 1950 | 15,844,986 | 80.0 | 609 | 68.6 |

At the close of 1950, oil company holdings in concessions aggregated 15,844,986 acres, which comprised only 7.03 percent of the total




**CRUDE RESERVES AND CUMULATIVE PRODUCTION**

**(Millions of Barrels)**

| End of Year | Estimated Reserves | Cumulative Production |
|---|---|---|
| 1925 | 500 | 38 |
| 1935 | 2,900 | 1,148 |
| 1945 | 7,035 | 3,200 |
| 1946 | 7,211 | 3,588 |
| 1947 | 7,296 | 4,023 |
| 1948 | 7,643 | 4,513 |
| 1949 | 8,245 | 4,995 |
| 1950 | 8,721 | 5,542 |
| 1951 (p) | 9,100 | 6,165 |

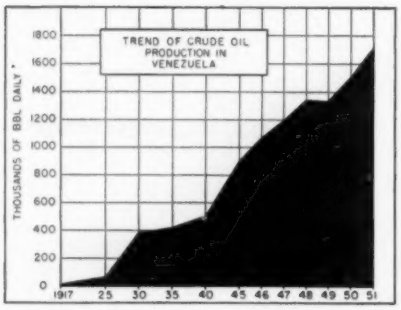
(p) Preliminary estimates

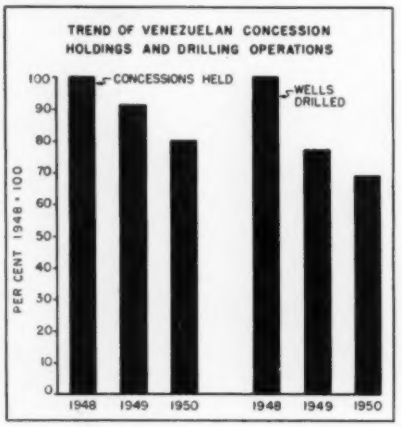
**CRUDE OIL PRODUCTION RELATED TO MER**

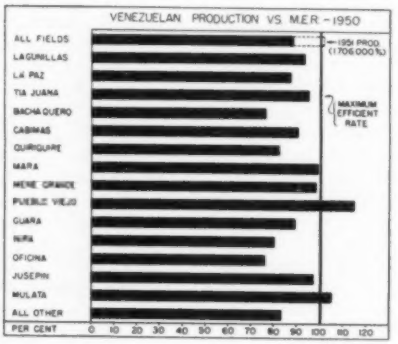
**Year 1950**

| Field | Maximum Efficient Rate | Daily Production | Additional Production Available | Per cent of MER |
|---|---|---|---|---|
| Lagunillas | 415,500 | 386,806 | 28,703 | 93 |
| La Paz | 179,259 | 156,319 | 22,940 | 87 |
| Tia Juana | 165,755 | 157,270 | 8,485 | 95 |
| Bachaquero | 147,816 | 113,416 | 34,400 | 76 |
| Cabimas | 87,378 | 78,735 | 8,643 | 90 |
| Quiriquire | 78,301 | 64,297 | 14,004 | 82 |
| Mara | 80,081 | 78,858 | 1,223 | 99 |
| Mene Grande | 46,834 | 45,956 | 878 | 98 |
| Pueblo Viejo | 4,604 | 5,309 | —705 | 115 |
| Guara | 64,709 | 57,767 | 6,942 | 89 |
| Nipa | 47,746 | 38,437 | 9,309 | 80 |
| Oficina | 55,646 | 42,475 | 13,171 | 76 |
| Jusepin | 25,033 | 24,246 | 787 | 97 |
| Mulata | 17,542 | 18,420 | —878 | 105 |
| Others | 276,694 | 229,674 | 47,020 | 83 |
| Total | 1,692,907 | 1,497,985 | 194,922 | 88 |
| 1951 Production | ..... | 1,706,011 | ..... | 101* |
| Change from 1950 | ..... | +208,026 | —13,104* | |

* On basis of 1950 Maximum efficient rate.




land area in the country. Only 2.61 percent of the combined concessions held at the close of 1950 were productive of oil and gas. Large areas of land which are considered prospective for oil and gas remain unexplored and undeveloped and are awaiting the decision of the government to grant new concessions.

Data for 1950 revealed a maximum efficient production rate for all fields in Venezuela of 1,692,907 barrels daily. Production in 1950 was within 12 percent of the maximum limit, which provided a margin of about 195,000 barrels daily. Preliminary production figures for 1951 indicated a daily average of 1,706,011 barrels, which represented an increase over 1950 of 208,026 barrels daily. Later MER data are not yet available, but 1951 exploratory results make it appear unlikely that the MER was increased to any appreciable extent.

All of the new fields found in 1951 were located in Eastern Venezuela, and none of these was initially considered of major importance. Meanwhile, many important fields have closely approached their economic limits, and two of these, Pueblo Viejo and Mulata, had already exceeded the MER in 1950. These facts make it plain that new sources of supply must be developed, and soon, if Venezuela expects to hold her position as a major source of oil in the Western Hemisphere.

The larger share of the increase in Venezuela's oil production in 1951 was obtained from fields in the Bolivar Coastal area; at Lake Maracaibo; and also from Quiriquire, Nipa, Oficina, Chimire, Boscan, Tucupido, and Pedernales. The rise in the country's oil production has been phenomenal since 1946, when the total daily output exceeded a million barrels for the first time. Except for a slight decline in 1949, the production trend has been sharply upward during the past six years. Cumulative crude oil production through 1951 is estimated at 6,164,922,000 barrels, which comprised about 8.8 percent of the world's production to date.

An astounding fact is that Venezuela has produced in the past six years more than 48 percent of all the oil produced by the country since 1917. Furthermore, production in the past six years comprised nearly 59 percent of the oil added to reserves by new discoveries, extensions and revisions. Production in 1951 was at the rate of about 62 percent of the total reserve additions. Obviously, if Venezuela continues to increase production during the next five years to a rate of perhaps 2,200,000 barrels daily, new sources of supply must be developed to provide a more adequate margin of productive capacity.

The need for more drilling in Venezuela is emphasized by the fact that in the past two six-year periods, 1940-45 versus 1946-51, oil production has increased 140 percent, while drilling operations during the same periods have shown a net increase of only 75 percent. Official drilling statistics for the years 1946-50 reveal an annual average of 500 development wells and only 51 wildcat wells completed yearly. The peak year in drilling was 1948, when 886 wells were drilled for a total footage of 4,466,000 feet.

Recent reports indicate that drilling operations are being increased, and operating companies have announced a stepped-up drilling program for 1952. Topographical and aerial surveys have been conducted over a wide area involving more than 25,000,000 acres. Many favorable areas have been mapped by the operating companies and await the granting of new concessions. Large areas favorable for oil exploration and development are yet to be made available in the states and territories of Lara, Trujillo, Merida, Portuguesa, Yaracuy, Cojedes, Apure, Delta Amacuro, Sucre, Northern Bolivar and Northern Amazonas.

Venezuela has the largest exportable supply of oil in the world. During the past four years, exports of crude oil and products have comprised 95 percent of the domestic supply of all oils. In 1951, it is estimated that the total demand exceeded total supply by about 7,000 barrels daily. Exports of crude oil and products in 1951 were over 25 percent greater than the quantity exported in 1948. Exports in 1951 exceeded 1,600,000 barrels daily, compared with a domestic supply of 1,712,000 barrels daily. Relatively small domestic requirements of about 95,000 barrels daily provided a net surplus supply of 1,617,000 barrels daily in 1951.

While internal industrial expansion is expected to bring about a material increase in future domestic requirements, Venezuela undoubtedly will continue to find her largest market in the Western Hemisphere. The outlook for an increase in world demand of at least 27 percent by 1956 makes it evident that

Ule-Amuay 24/26-inch crude line serves Creole's new 75,000-barrel Amuay Bay refinery.

## WORLD SUPPLY AND DEMAND IN 1950 AND 1951

| 1950 Data | World | United States | Other No. Amer. | Venezuela | Other So. Amer. | Middle East | Europe-Russia | Far East |
|---|---|---|---|---|---|---|---|---|
| Crude oil reserves 1/1/51 | 95,339,000,000 | 26,218,000,000 | 3,000,000,000 | 8,721,000,000 | 1,200,000,000 | 48,200,000,000 | 6,500,000,000 | 1,500,000,000 |
| Per cent of world | 100.0 | 27.5 | 3.2 | 9.2 | 1.2 | 50.5 | 6.8 | 1.6 |
| Number of producing wells | 500,979 | 460,000 | 4,715 | 6,934 | 7,300 | 530 | 16,000 | 5,500 |
| Reserves per well | 190,305 | 57,000 | 636,000 | 1,257,000 | 164,000 | 90,943,000 | 406,250 | 272,720 |
| Crude Production, 1950 | 2,795,320,000 | 1,971,845,000 | 101,220,000 | 546,765,000 | 100,000,000 | 655,000,000 | 325,000,000 | 95,500,000 |
| Daily average | 10,396,000 | 5,402,000 | 277,000 | 1,498,000 | 274,000 | 1,794,000 | 890,000 | 261,000 |
| Per cent of world | 100.0 | 52.0 | 2.7 | 14.4 | 2.7 | 17.2 | 8.5 | 2.5 |
| Daily production per well | 21 | 12 | 58 | 216 | 37 | 3,380 | 55 | 47 |
| Cumulative production | 65,753,706,000 | 40,916,479,000 | 2,680,000,000 | 5,542,227,000 | 1,840,000,000 | 4,175,000,000 | 8,500,000,000 | 2,100,000,000 |
| Per cent of world | 100.0 | 62.3 | 4.1 | 8.4 | 2.8 | 6.3 | 12.9 | 3.2 |
| Number of oil refineries | 688 | 347 | 51 | 16 | 45 | 15 | 186 | 28 |
| Daily crude capacity | 12,505,000 | 6,530,000 | 540,000 | 335,000 | 1,220,000 | 1,200,000 | 2,380,000 | 300,000 |
| Still runs, 1950 | 3,822,248,000 | 2,094,867,000 | 157,000,000 | 89,581,000 | 400,000,000 | 383,000,000 | 602,300,000 | 95,500,000 |
| Daily average | 10,467,000 | 5,740,000 | 430,000 | 246,000 | 1,090,000 | 1,050,000 | 1,650,000 | 261,000 |
| Per cent of world | 100.0 | 54.8 | 4.1 | 2.4 | 10.4 | 10.0 | 15.8 | 2.5 |
| Crude surplus or shortage | —26,918,000 | —123,022,000 | —55,780,000 | +457,184,000 | —309,000,000 | +272,000,000 | —277,300,000 | —0— |
| Daily average | —73,000 | —338,000 | —152,000 | +1,252,000 | —822,000 | +745,000 | —759,000 | —0— |
| Domestic supply, all oil | 4,014,797,000 | 2,153,561,000 | 104,620,000 | 548,595,000 | 102,373,000 | 655,548,000 | 353,500,000 | 96,600,000 |
| Daily average | 11,000,000 | 5,900,000 | 290,000 | 1,502,000 | 280,000 | 1,800,000 | 970,000 | 264,000 |
| Domestic demand, all oil | 4,015,884,000 | 2,372,084,000 | 195,000,000 | 27,740,000 | 227,000,000 | 195,000,000 | 811,100,000 | 188,000,000 |
| Daily average | 11,000,000 | 6,499,000 | 534,000 | 76,000 | 621,000 | 534,000 | 2,222,000 | 520,000 |
| Surplus or shortage | —0— | —218,523,000 | —90,380,000 | +520,855,000 | —124,627,000 | +460,548,000 | —457,600,000 | —91,400,000 |
| Daily average | —0— | —599,000 | —244,000 | +1,426,000 | —341,000 | +1,266,000 | —1,252,000 | —256,000 |
| **1951 Estimates** | | | | | | | | |
| Crude production, 1951 | 4,287,695,000 | 2,240,000,000 | 126,000,000 | 622,695,000 | 105,000,000 | 734,000,000 | 360,000,000 | 100,000,000 |
| Daily average | 11,746,000 | 6,136,000 | 345,000 | 1,706,000 | 287,000 | 2,011,000 | 986,000 | 274,000 |
| Per cent increase | 13.1 | 13.5 | 24.5 | 14.0 | 4.7 | 12.1 | 10.8 | 4.9 |
| Still runs, 1951 | 4,211,900,000 | 2,360,000,000 | 185,000,000 | 112,800,000 | 430,000,000 | 358,000,000 | 866,100,000 | 100,000,000 |
| Daily average | 11,540,000 | 6,460,000 | 507,000 | 309,000 | 1,178,000 | 980,000 | 1,825,000 | 274,000 |
| Per cent increase | 10.2 | 19.5 | 18.0 | 25.6 | 8.1 | —6.7 | 10.5 | 5.0 |
| Crude surplus or shortage | +75,795,000 | —120,000,000 | +59,000,000 | +509,895,000 | —325,000,000 | +376,000,000 | —306,100,000 | —0— |
| Daily average | +206,000 | —324,000 | —162,000 | +1,397,000 | —891,000 | +1,031,000 | —829,000 | —0— |
| Domestic supply, all oil | 4,535,185,000 | 2,445,000,000 | 130,000,000 | 624,885,000 | 107,500,000 | 734,500,000 | 392,000,000 | 101,300,000 |
| Daily average | 12,425,000 | 6,700,000 | 356,000 | 1,712,000 | 294,000 | 2,012,000 | 1,074,000 | 277,000 |
| Per cent increase | 12.9 | 13.5 | 22.7 | 13.9 | 5.0 | 11.7 | 10.7 | 4.8 |
| Domestic demand, all oil | 4,417,700,000 | 2,580,000,000 | 235,000,000 | 34,700,000 | 250,000,000 | 215,000,000 | 905,000,000 | 198,000,000 |
| Daily average | 12,103,000 | 7,069,000 | 644,000 | 95,000 | 685,000 | 589,000 | 2,479,000 | 542,000 |
| Per cent increase | 10.0 | 9.4 | 20.6 | 25.0 | 10.3 | 10.3 | 11.6 | 4.2 |
| Daily surplus or shortage | +322,000 | +369,000 | —288,000 | +1,617,000 | —391,000 | +1,423,000 | —1,405,000 | —265,000 |

View of a residential street in Caracas, Venezuela. Photo courtesy Creole Petroleum Corp.

proportionately greater oil supplies will be needed from Venezuela.

In the light of presently foreseeable trends, it is not likely that the Western Hemisphere will be confronted with an oversupply of oil, at least during the next five years. Developments in the United States, Canada and Mexico favor continuing expansion of domestic supplies, but the need for greater productive capacity and the anticipated growth in demand will beyond doubt continue to make North America dependent upon Venezuela for supplemental supplies. Trade statistics show that 88 percent of Venezuela's surplus oil supply is marketed in the northern continent, while 12 percent moves into European and neighboring South American markets.

Future trends point definitely to the domination of European and Far Eastern markets by the Middle East, perhaps ultimately to the complete exclusion of imports from the Western Hemisphere. While this may affect existing foreign trade in the United States and Venezuela, the prospective increase in domestic requirements in this hemisphere will more than counterbalance such losses. The exigencies created by the Iranian situation have temporarily altered this trend, which has been in progress since 1944. Between 1944 and 1950, petroleum exports from the United States showed a decline of 47 percent. From a peak in 1944 of 207,000,000 barrels, exports in 1950 were reduced to only 111,000,000 barrels. Last year, United States exports rose to a total of about 150,000,000 barrels. Once Iran returns to production, it is likely that petroleum exports from the United States may be confined mainly to specialty products, with a probable resumption of the downward trend in total exports.

The only visible threat of world oversupply over the next five years is in the Middle East. With oil production there rising to new high levels, even to the exclusion of Iran, and with new potential sources of supply being discovered and developed in widely separated localities, the Middle East definitely holds the balance of world power so far as the oil industry is concerned.

While the demand for petroleum in Europe and the Far East is expected to show an increase of at least 835,000 barrels daily by 1956, it is seen that this presents no supply problem from sources in the Middle East. Its vast reserves offer productive potentialities far greater than current output, but self interest, both of the operating companies and of governments dependent upon them for income, counsel against attempting to deluge world markets or to ignore the concepts of sound conservation.

While many forecasters anticipate a leveling off of the demand for petroleum after 1953, it is apparent that supply requirements this year and next will focus greater attention upon the need for expanded production facilities in the United States and in Venezuela. Domestic demand in the United States may exceed 7,900,000 barrels daily by the end of 1953, a gain over 1951 of about 11.2 percent. To meet these requirements from domestic sources, the United States would have to increase production in the next two years by some 1,200,000 barrels daily. This would not raise the maximum efficient limit above the existing margin, nor would it provide the additional oil that may be needed to meet probable export requirements.

Studies recently completed by the Petroleum Administration for Defense in Washington indicate that a drilling program of 50,000 wells a year through 1955 may be expected to increase the crude oil productive capacity of the United States by about 360,000 barrels daily each year. If such a program added 720,000 barrels daily to the productive capacity by 1953, and the supply of natural gasoline was increased by another 80,000 barrels daily, there would still be a shortage of 400,000 barrels daily. Viewed from any angle, it is evident that supplemental oil supplies will continue to be needed in North America in increasing quantities, and Venezuela holds the key to the future availability of such supplies.

*The second article in this series will appear in an early issue.*

### WELLS DRILLED IN VENEZUELA

| | Development Wells | Wildcat Wells | Total Wells Drilled | Thousands of Feet Drilled |
|---|---|---|---|---|
| Avg. 1912-20 | 4 | 2 | 6 | 12 |
| Avg. 1921-30 | 237 | 14 | 251 | 582 |
| 1931 | 106 | 14 | 120 | 269 |
| 1932 | 57 | 2 | 59 | 129 |
| 1933 | 130 | 3 | 133 | 347 |
| 1934 | 239 | 5 | 244 | 778 |
| 1935 | 179 | 9 | 188 | 587 |
| 1936 | 302 | 14 | 316 | 1,050 |
| 1937 | 531 | 14 | 545 | 1,545 |
| 1938 | 511 | 10 | 521 | 1,616 |
| 1939 | 431 | 21 | 452 | 1,687 |
| 1940 | 409 | 20 | 429 | 1,745 |
| 1941 | 425 | 13 | 438 | 1,843 |
| 1942 | 435 | 12 | 447 | 1,599 |
| 1943 | 204 | 18 | 222 | 993 |
| 1944 | 370 | 17 | 387 | 2,165 |
| 1945 | 506 | 29 | 535 | 3,020 |
| 1946 | 574 | 78 | 652 | 3,290 |
| 1947 | 725 | 62 | 737 | 3,948 |
| 1948 | 834 | 52 | 886 | 4,466 |
| 1949 | 626 | 56 | 682 | 3,582 |
| 1950 | 548 | 61 | 609 | 3,387 |
| Cumulative | 10,548 | 678 | 11,226 | 43,974 |

### NATURAL GAS RESERVES AND CUMULATIVE PRODUCTION
(Billions of Cubic Feet)

| | | |
|---|---|---|
| 1945* | 14,500 | 1,787 |
| 1949 | 17,596 | 3,483 |
| 1950 | 16,468 | 4,040 |
| 1951 (p) | 15,500 | 4,615 |

(p) Preliminary estimates
* No data available prior to 1945

### ANNUAL CRUDE OIL PRODUCTION

| | Annual Total | Daily Average |
|---|---|---|
| 1917 | 121,000 | 331 |
| 1918 | 321,000 | 1,000 |
| 1919 | 305,000 | 1,000 |
| 1920 | 462,000 | 1,600 |
| 1921 | 1,459,000 | 4,000 |
| 1922 | 2,262,000 | 6,000 |
| 1923 | 4,127,000 | 11,000 |
| 1924 | 9,139,000 | 25,000 |
| 1925 | 20,046,000 | 55,000 |
| 1926 | 36,245,000 | 99,000 |
| 1927 | 60,828,000 | 167,000 |
| 1928 | 106,056,000 | 290,000 |
| 1929 | 135,981,000 | 373,000 |
| 1930 | 135,195,000 | 370,000 |
| 1931 | 116,517,000 | 319,000 |
| 1932 | 116,326,000 | 318,000 |
| 1933 | 118,178,000 | 324,000 |
| 1934 | 135,506,000 | 372,000 |
| 1935 | 148,727,000 | 407,000 |
| 1936 | 154,217,000 | 421,000 |
| 1937 | 185,989,000 | 510,000 |
| 1938 | 187,910,000 | 515,000 |
| 1939 | 204,880,000 | 561,000 |
| 1940 | 183,884,000 | 502,000 |
| 1941 | 226,873,000 | 622,000 |
| 1942 | 148,020,000 | 405,000 |
| 1943 | 179,383,000 | 491,000 |
| 1944 | 257,037,000 | 702,000 |
| 1945 | 323,403,000 | 886,000 |
| 1946 | 388,478,000 | 1,064,000 |
| 1947 | 434,890,000 | 1,191,000 |
| 1948 | 489,998,000 | 1,339,000 |
| 1949 | 482,299,000 | 1,321,000 |
| 1950 | 546,765,000 | 1,498,000 |
| 1951 (p) | 622,695,000 | 1,706,000 |
| Cumulative | 6,164,922,000 | |

(p) Preliminary estimate

### VENEZUELAN SUPPLY AND DEMAND
(Daily Averages)

| | 1948 | 1949 | 1950 | 1951 (p) |
|---|---|---|---|---|
| Crude Oil Production | 1,338,794 | 1,321,367 | 1,497,985 | 1,706,000 |
| Natural Gaso. Prod. | 1,765 | 4,340 | 5,141 | 6,000 |
| Imports, Pet. Products | 1,978 | 1,315 | 1,450 | 1,300 |
| New Supply | 1,342,537 | 1,327,022 | 1,504,576 | 1,713,300 |
| Crude Oil Exports | 1,199,178 | 1,156,633 | 1,227,550 | 1,400,000 |
| Refined Oil Exports | 86,000 | 101,871 | 187,000 | 215,000 |
| Domestic Consumption | 40,683 | 54,013 | 76,000 | 95,000 |
| Total Demand | 1,331,232 | 1,319,961 | 1,499,300 | 1,720,200 |
| Stock Change | +11,303 | +7,061 | +5,276 | —6,900 |
| Total Stock, all oil* | 17,143 | 19,720 | 21,645 | 19,127 |
| Refinery Still Runs | 118,882 | 145,384 | 245,428 | 320,000 |

* Thousands of bbl.
(p) Preliminary estimates

*Southeastern Iraq Field Joins the Growing List of Important Producing Areas in the Middle East*

# ZUBAIR FIELD TO PRODUCE 45,000 BARRELS DAILY IN 1952

▲ **Map showing route of pipe line from Zubair field to Fao on the Shat al Arab river at the head of the Persian Gulf.**

◀ **Christmas tree fittings at the wellhead of Zubair No. 4.**

CEREMONIES celebrating the opening of the Zubair field in southeastern Iraq to commercial production were held on January 10. H. S. Gibson, managing director of Basrah Petroleum Co., and other company officials were in the field to greet Iraq Prime Minister Nuri el-Said Pasha, his staff and press representatives.

Movement of oil from the field into world trade channels actually began a month earlier. The first tanker cleared the loading jetty at Fao on December 19, 1951, some nine months ahead of the date which the company had set as a target in its guarantees to the Iraq government.

The Zubair field has been under development since 1948 and now gives promise of being one of the world's great oil fields. Thus far 13 wells have been drilled without a dry hole. The field is being developed on a 600-acre pattern within the known productive area and at the same time step-out drilling is being done. Five rigs are running. The No. 2 well was drilled about 10 miles southeast of No. 1. No. 13 was drilled about four miles north of No. 1 so that the proven area extends about 14 miles north and south. A new step-out location has been staked about five miles south of No. 2. If this is a producer, the field will have been proved to extend about 19 miles north and south and five miles east and west.

Step-out drilling in the north has been halted temporarily since the field is about to encroach on the Shaiba air field which was developed during World War II by the Royal Air Force and is still being operated. It will be necessary to move the air strip if further drilling is undertaken in a northerly direction.

Producing formation in the Zubair field is the Middle Cretaceous. A series of sands have been penetrated at depths between 10,000 and 11,000 feet. The third zone has been found in some wells to have a thickness of about 300 feet. The producing formation is similar to that in the prolific Burgan field in Kuwait to the south although encountered at a much greater depth. It is unlike the limestone fields of Oligocene and Miocene age in neighboring Iran or the upper Cretaceous and Miocene lime formations in the Mosul and Kirkuk regions north and west of the Basrah Petroleum Co. concession.

Oil being produced at Zubair is about 33 gravity. It contains some sulfur and some hydrogen sulfide. The $H_2S$ in solution is not great enough to require the installation of field stabilizers. Socony-Vacuum Oil Co. has posted a price of $1.67 fob. Fao for the crude, a price in line with other Persian Gulf crudes.

Present plans of the operating company are to produce about 2.2 million tons (45,000 b/d) in 1952. Thereafter production will rise year by year in line with demand. The company has obligated itself to produce eight million tons (about 160,000 b/d) in 1956.

Basrah has drilled two other test wells in the general region of the Zubair field. Oil similar to that at Zubair was found at 8,300 feet at Nahr Umr on the banks of the Euphrates river near the Lake al Hammar marshes northwest of Basra. Belief is that this is a relatively small salt dome field and immediate development is not contemplated. Another nearby wildcat at Ratawi had a showing, but was abandoned because of mechanical difficulties without complete testing. Development of this and other possible structures will be jobs for future consideration.

Surface geological work has been done over a large part, if not all of the 90,000 square miles embraced in the Basrah concession. Geophysical reconnaisance to search out possible deep seated structures remains to be carried out.

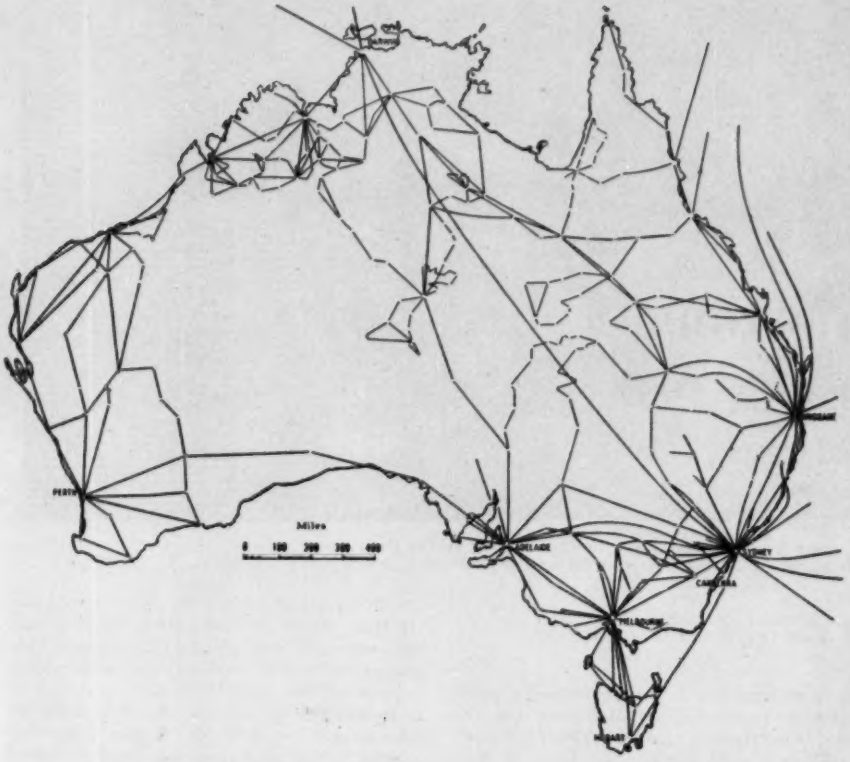
To move oil from the field, a 75-mile pipe line has been laid from Zubair to the port of Fao near the mouth of the Shat al Arab river below Abadan. The line consists of 65 miles of 12-inch and 10 miles of 16-inch pipe. As indicated in the accompanying map, the line is laid from Zubair west to the river and follows the road along its bank from that point to Fao. Although not most direct, the route was selected to avoid difficult terrain.

At Fao a tank farm has been erected containing eight tanks of 135,000 barrels capacity each. Two loading jetties have been built to provide berths for simultaneous loading of two tankers. Loading rate will be nearly 2,000 tons per hour.

As in the case of all such projects undertaken in the Middle East, it has been necessary for Basrah to make a very large investment before it was possible to begin oil production. In this case the concession first was

*(Please turn to page 67)*

Map showing extensive airline coverage of the Australian sub-continent.



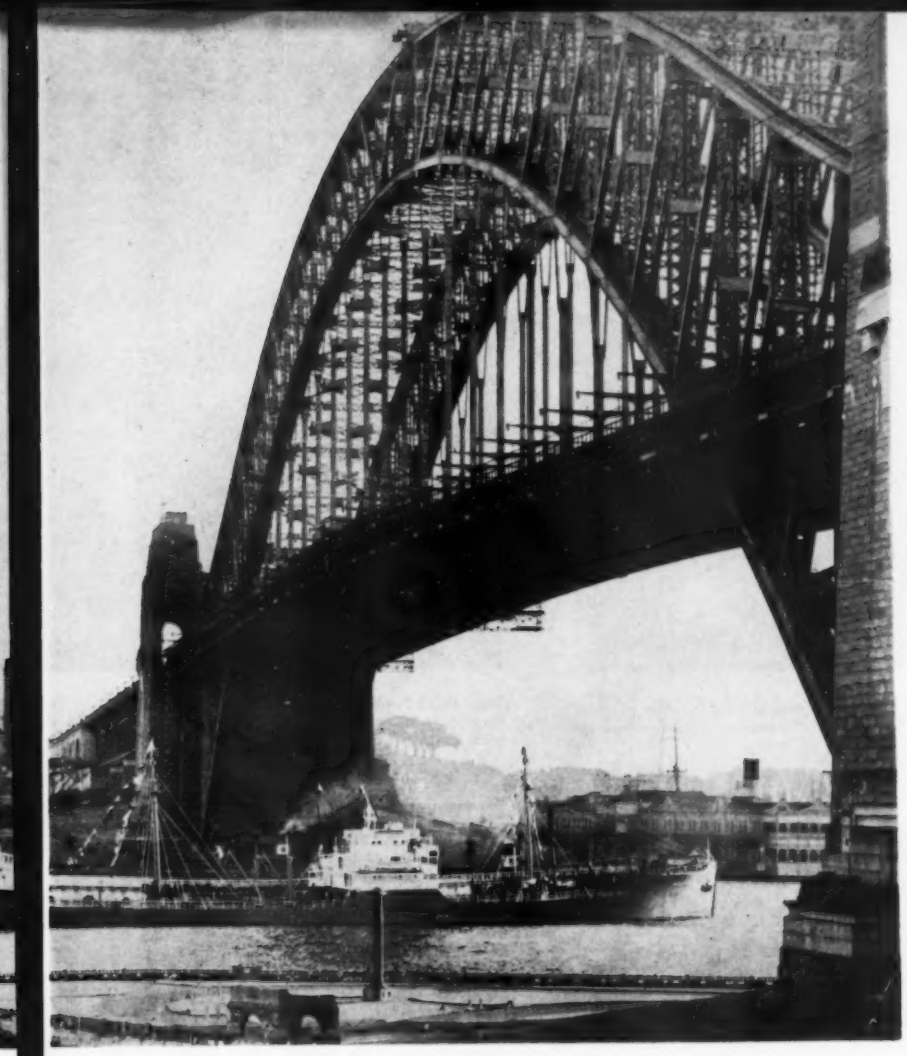
# SHORTAGES OF COAL AND ELECTRICAL ENERGY STIMULATE OIL TRADE IN AUSTRALIA

***This review of the general supply and demand situation in Australia was compiled for World Petroleum by the Petroleum Information Bureau (Australia) which was organized in 1951 under the leadership of M. T. Lloyd who was managing director of Commonwealth Oil Refineries prior to his recent retirement. Executive officer is A. W. Colley, formerly deputy chief information officer of the Ministry of Works, London.***

IN 1950 the Australian consumption of petroleum products in the inland market was approximately four million tons, representing double the 1939 rate of sales. During this same period the country's population increase, estimating between census periods, was not more than one and one-quarter million, the present-day population figure being just over eight and one quarter million.

There are two major reasons for this lack of proportion between increase in petroleum consumption and increase in population. One is the flood of wealth which has poured into Australia largely as a result of the strong world demand for the country's primary products, notably wool, wheat, meat and fruits, and the phenomenal prices they command judged by pre-war standards. The other is the great strides made during and after the war in Australian manufacturing and processing potential. It is the purpose of this article to show how these factors have operated and their proportional share in effecting growth of consumption.

In order to present the material in as concise and practical a form as possible, it has been collated into sections under four main headings, "White Products," "Residual Fuel Oils," "Lubricants" and "Bitumen."



**At present, Australia depends entirely on crude and product imports by tanker. Here the Stanvac Canberra passes under famed Sydney Harbor Bridge on her maiden voyage to the Commonwealth. She is carrying a full cargo of motor and aviation gasoline from Standard-Vacuum's Sungei Gerong refinery in Indonesia.**

**White Products—** The market for petroleum fuels in 1949 was temporarily inflated by a general coal strike which lasted for nearly two months and led to the usage of petroleum products as substitute sources of fuel and power. If allowance is made for the 1949 coal strike, it appears that the market for petroleum fuels other than power kerosine has been growing at an increasing rate in recent years. The major factors which have caused this are economic prosperity, a rapidly increasing population, and the failure of sources of fuel and power, other than petroleum, to keep pace with the expanding requirements of the community.

The main source of fuel and power in Australia is black coal. In the decade 1938/9 to 1948/9, black coal production increased only 18.4 percent as against an increase in volume of manufacturing industries of approximately 60 percent. Electricity and gas rationing have been features of our post-war economy, but the tendency has been for restrictions to become more stringent each year, which is indicative of the failure of coal supplies to increase as rapidly as the general economy. For the three year period 1947/8 to 1950/51, black coal increased only 11.5 percent while the increase in petroleum fuels will be about 60 percent for the three year period of 1948 to 1951. It is estimated that the shortage of black coal is three million tons a year which is equal to approximately 20 percent of current production.

The government has sought to overcome the coal shortage by large-scale development of open-cut mining and construction of hydro-electric schemes. These involve the consumption of considerable quantities of petroleum products, particularly in earth-moving equipment and transport.

It will thus be seen that not only has the petroleum industry been called upon to bridge the gap due to other sources of fuel and power not expanding as rapidly as the general economy, but also efforts to overcome the coal shortage have superimposed additional demands for petroleum products.

It is anticipated that there will be some recession from the high level of current export income partly due to lower prices for wool and partly to a reduced volume of wheat and other food products available for export. On the other hand, gas and electric supply authorities do not expect ample supplies to be available until at least 1956, and railway authorities also do not anticipate being able to handle all freight offered until that year at the earliest. Altogether, it seems reasonable to assume that the combined effect of the foregoing factors will lead to a high rate of growth of the market for petroleum products for several years.

*Aviation Gasoline* — Australian commercial aviation began nearly 30 years ago when the Queensland and Northern Territory Aerial Service Ltd. commenced regular air service between Charleville and Cloncurry and the Western Australian Co. started a regular service between Geraldton and Derby on the northern coast of western Australia. It is significant that the first air service went into operation in the outback. Thus it was that settlers in northern and eastern Australia became accustomed to air transport long before the capital cities of the states were linked by this means.

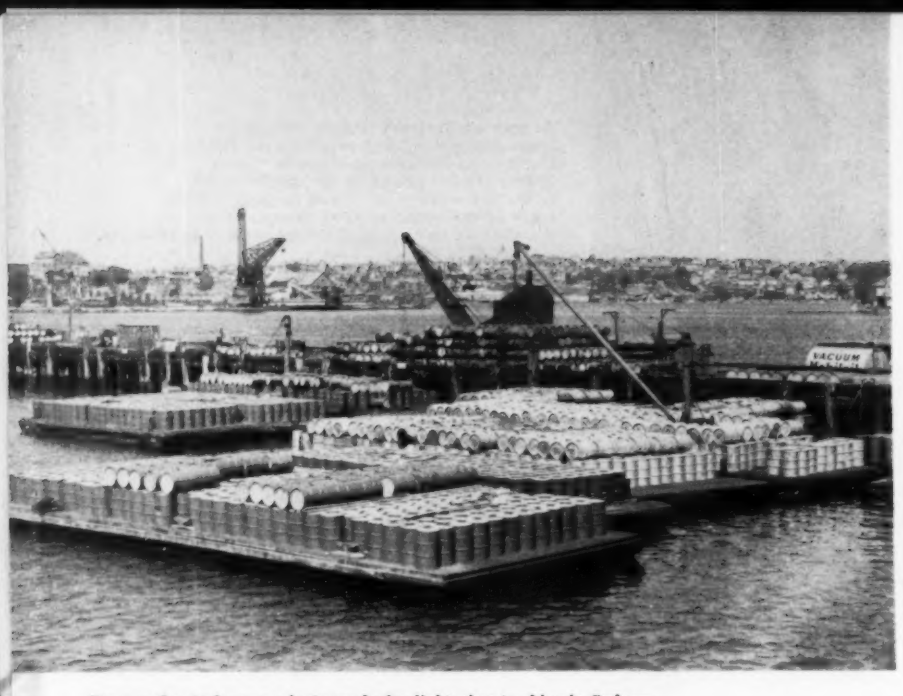
Today air travel in Australia is highly developed, with services operating between all main centers of population and an extensive network of feeder lines to "backblock" areas. In a continent of nearly 3,000,000 square miles, it is not surprising that air travel has become the logical and necessary mode of transport.

The total domestic route mileage for the year ended June, 1951 was 75,000 miles. The number of passengers carried for the year ended June last was 1,750,000 approximately, which was an increase of 250,000 or 16 percent over the previous year. Aviation gasoline sales up to October 1951 were 12 percent over 1950 indicating an annual consumption of 1,135,000 barrels as compared with 1,010,000 barrels in 1950.

*Motor Spirit* — The effects of government rationing of gasoline which was terminated in Feb. 1950 can now be regarded as dispersed and there is an increasing rate of growth. The reasons for this are to be found in the general economic factors already mentioned, which have led to a rapid increase in the number of motor vehicles registered. The number of commercial vehicles has more than doubled since pre-war, while the number of motor cars has increased by approximately 50 percent. Whereas, pre-war, there was one commercial vehicle to every two motor cars, there are now two to every three motor cars. The increase in proportion of commercial vehicles registered reflects the inability of railways and shipping to handle all the trade offering. Consequently, restrictive regulations on road transport which applied pre-war have had to be relaxed considerably.

In the five years prior to the war, the increase in the number of vehicles per thousand of population was over 30 percent and in the five years since the end of the war it was nearly 50 percent. The number of motor vehicles, other than motorcycles, is now 165 per thousand of population. Approximately one-seventh (nearly £100,000,000) of the total value of imports into Australia last year was spent on motor vehicles.

The number of new motor vehicles regis-



Drummed petroleum products ready for lightering to ships in Sydney Harbor for redistribution to the many islands of the South Pacific, most of which receive their products via this method.

Tank truck loading rack for aviation gasoline service at Mascot Aerodrome, Sydney, with PanAm Clipper overhead.

tered in Australia for the twelve months ended June last was a record:

| | |
|---|---|
| Motor cars | 127,700 |
| Commercial vehicles | 77,900 |
| Motorcycles | 27,200 |
| Total | 232,800 |

Gasoline sales in 1951 were rising at a 20 percent rate up to September indicating consumption during the year of 184 million barrels compared with 153 million in 1950.

*Illuminating Kerosine* — Industry sales to the end of August, 1951 were over 30 percent greater than for the corresponding period of the previous year. If allowance is made for the general coal strike in 1949, it will be seen that the market for lighting kerosine has been progressively expanding in recent years. The reason for this is to be found in the increasing severity of electricity and gas rationing and a shortage of firewood. For example, the metropolitan area of Sydney has been divided into zones and each zone has been without normal electricity supplies for six days in every five weeks. In Melbourne, electricity restrictions have also been severe, and in addition, gas rationing was in operation for six months of 1951. The supply of kerosine-operated equipment, particularly space heaters and hot water systems, has increased rapidly during recent years. In 1950 Commonwealth consumption was just short of one million barrels, double the 1939 rate.

*Power Kerosine* — Wheat is the most important single crop in Australia and provides the main market for power kerosine. The wheat harvest in 1947/8 was a record, but since then the area sown for wheat has declined each year. For 1951, the area sown was 3,000,000 acres less than for 1947/48 and 3,500,000 acres less than the average for the decade preceding the war.

The main reason for the decrease in wheat acreage is to be found in higher relative prices being received for wool. The average price of greasy wool during the 1950/51 season was double that of the previous seasons and approximately fourteen times the pre-war price. By contrast, wheat prices have increased six-fold.

The second main outlet for power kerosine is in the growing of sugar cane. In order to fulfill an agreement with the United Kingdom government, steps are being taken to increase production of sugar by one-third, which will tend to offset a fall in the wheat acreage.

The increasing use of tractors using diesel fuel and gasoline is also tending to reduce the market for power kerosine. Sales in 1950 totaled 2,230,000 barrels, a drop of 100,000 barrels since 1948.

Demand for diesel distillate and gas oil is increasing in Australia at an even more rapid pace than in the United States. Railroads, buses, tractors and trucks are being more generally powered with diesel engines. Electric trams are being supplanted by diesel buses. Private firms and individuals are installing diesel-operated auxiliary electrical generating equipment. Gas enrichment is requiring more gas oil, and, as previously mentioned, the government construction programs are large consumers of distillates.

CONSUMPTION OF PRINCIPAL WHITE PRODUCTS
(Thousands of Barrels)

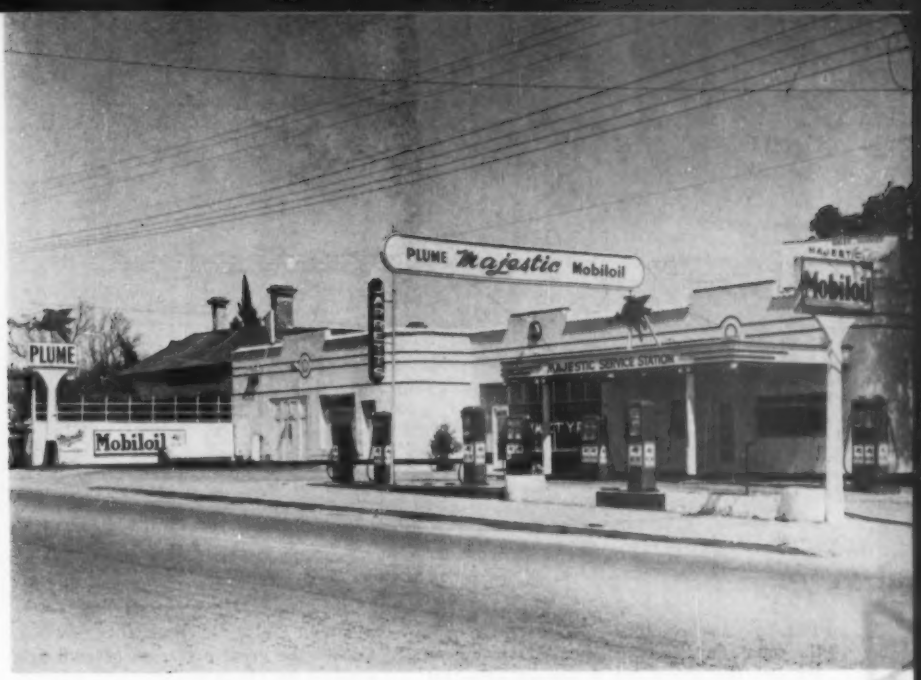
| Year | Aviation Gasoline | Motor Gasoline | Illum. Kerosine | Power Kerosine | Dist. |
|---|---|---|---|---|---|
| 1939 | 171 | 10,500 | 511 | 1,150 | 328 |
| 1946 | 622 | 9,460 | 643 | 1,810 | 575 |
| 1947 | 713 | 11,170 | 780 | 2,208 | 785 |
| 1948 | 832 | 11,500 | 802 | 3,330 | 1,100 |
| 1949 | 941 | 13,100 | 920 | 2,820 | 1,240 |
| 1950 | 1,013 | 15,400 | 991 | 2,230 | 1,685 |
| 1951 (Est.) | 1,135 | 18,300 | 1,290 | 2,180 | 2,400 |

**Residual Fuel Oils**— The rapid expansion of Australian secondary industries during World War II and in the following years was accompanied by a serious drop in output from the eastern N.S.W. coal fields, especially those mines producing the better grades. Added to this, the lack of opportunity for maintenance of plant and the inability to install sufficient new equipment during the war years built up a serious lag in construction and the replacement of obsolete equipment.

Consequently, the post-war years have been marked by the installation of much new equipment, especially in the electric power generation and railway traction fields. The dearth of coal has resulted in much of this, as well as a high proportion of rehabilitated plant being oil-fired, while modernization schemes and new construction projects have led to a greatly extended use of diesel powered equipment. It is not surprising, therefore, that the demand for fuel oil has increased rapidly during the post war years and that this demand should continue to grow as the lag in delivery of new equipment is being overtaken. In 1940 sales of fuel oil totaled 336,000 long tons. This was reduced to 297,000 tons in 1945 at the war's end, but by 1950 sales had risen to 1,237,000 tons, an increase of 268 percent in five years.

Five of the seven main railway systems in the commonwealth are today employing oil-firing of steam locomotives to an extent involving a considerable portion of their motive power. At least three of these plan to increase substantially the number of oil-fired locomotives in service before the middle of 1952, and this market is likely to increase by at least 30 percent during the year. An interesting development in this connection has been the combining of oil and coal firing in the locomotives of one railway system to enable the use of the low grade coal locally available. Since, on a thermal unit basis, fuel oil costs are in excess of coal costs in all cases, operating costs are thus reduced.

In the electric power generation field, where




**A change-over from multiple-brand stations to single brand stations is now in process in Australia.**

lower grade coals can be used, the use of fuel oil was largely planned to care for the peak load demand, but an ever-increasing proportion is being required for oil-fired high pressure boilers which are being installed, and to meet the growing demand for power, for which coal is not forthcoming.

Town gas supply, likewise, is being supplemented to an increasing extent by the use of oil, both in carburetted water-gas plants and oil gas plants, and the consumption of town gas industry climbed rapidly during 1950 and 1951. Present planning indicates a probable 50 percent increase in demand from this industry within the next two to three years. At the date of writing, the gas industry within the Commonwealth has not used heavy oil for gas production to any extent, but the results of experiments nearing completion suggest that this development is not far away.

As coal supply and coastal transport difficulties grew on the one hand and fuel demands increased rapidly on the other, there has been a rapidly growing demand from this source over the past four years with a strong tendency to favor fuel oil in new projects.

Despite government pressure for the use of local low-grade coals in two states where production is being actively developed, there is a growing inclination to view oil fuel supply as the more dependable in these states as well as elsewhere in the Commonwealth. The fear of breaks in the continuity of coal supply as a result of industrial troubles is engendering a strong feeling in many quarters that payment of the higher cost of fuel oil is a worthwhile insurance against shutdowns.

Technical advances in the application of fuel oil and those made possible in some processes by its use have also been, as elsewhere, a factor in increasing the demand in Australia.

Demand for space heating, always very small because of a warm to mild climate over the greater part of the Commonwealth, still has shown a tendency to increase in the southern states, but it is unlikely ever to reach significant proportions.

Projects, both under way and planned, suggest that the market for fuel oil will continue to expand at about the present rate for at least the next three years, after which it is probable that there will be a deceleration in the rate of increase, as existing coal production projects bear fruit. Production of higher grade coal is, however, likely to fall short of demand for many years to come and consequently a steady demand for fuel oils is envisaged over the next few years for certain critical purposes, and to supplement the lower calorific value coals, which will be increasingly available.

*Heavy Diesel Fuels* — Prior to 1945, electric power generation outside the six metropolitan areas of the Commonwealth and a few small zones was largely dependent upon diesel power, and formed the largest, and by far the most important, single section of the diesel fuel market. This picture has been changing rapidly, however, as government electric power projects have been developed, particularly in the south-east of the Continent and Tasmania, where hydroelectric and thermal stations are being both expanded and constructed to feed extensive networks.

While a few diesel power stations are being retained and expanded to act as peak-load feed-back stations for these networks, the majority are passing out of existence, as the areas they serve are linked into the main transmission lines; as a result there will be a gradual fall in demand from this source for the next two or three years, after which natural expansion in other areas will more than compensate for it.

The construction work involved in the development of these hydro-electric projects and in a number of open-cut coal mining schemes has called for the fairly extensive employment of diesel-powered equipment, which has created a heavy additional demand for diesel fuel over the last four years. Expansion of this work will call for increasing quantities of diesel fuel for a few years to come, and, at the date of writing, it would appear that slackening of demand from hydro-electric construction works as the tasks near completion will be more than compensated for by expansion of open-cut coal mining activities, in which diesel equipment is used extensively.

During the years 1948-51, the failure of public electric supply undertakings to meet electric power demands led to the widespread installation of auxiliary diesel-powered electric generating plants by industry and relatively minor development has contributed appreciably towards the unprecedented growth of the diesel fuel market during the post war years.

A quite substantial portion of the increase in the market during the period, however, has come from the primary production field, where the use of diesel power has multiplied as the result of a steady but fairly rapid increase in mechanization since the end of the war.

While the increase in the use of diesel motive power on Australian railway systems has, until this year, been limited to a relatively few rail cars which have not made a very notable impression on the diesel fuel market, 1951 marked the first important use of diesel locomotives. Orders placed by all Class 1 railway systems during the past few years will account for 287 units being placed in service and it is estimated that completion of delivery of these, which is expected by mid-1953, will result in Australian railways using an additional 100,000 long tons of diesel fuel per annum. Some railway systems plan to place fairly extensive additional orders and at least one to dieselize its motive power entirely over the next few years.

Small marine craft have accounted for a not unimportant portion of the increase in

**A typical Australian service station in the garden suburb of Killara, New South Wales.**

the country's diesel fuel consumption during the last few years and it now appears that the expansion of the fishing industry during that time will be eclipsed as current projects are completed during the next two to three years. Therefore, this section of the market is expected to account for an appreciable increase in demand in the near future.

Thus it is anticipated that the substantial and rapid increase in the Australian diesel fuel market since World War II terminated will be exceeded during the next few years, despite the progress already made in rehabilitating and modernizing both primary and secondary industry, which has accounted for so much of the increased demand to date.

Demands for bunkers have increased in Australia very considerably since the war, due to several reasons such as the increased passenger traffic to and from Australia caused by migration and tourist demands. Local requirements for bunkers have also increased on pre-war standards with operation of new tonnage, such as that operated by the Australian Shipping Board. Estimated deliveries of diesel oil and fuel to ships bunkers are as follows:

| | (Long Tons) Diesel | Fuel |
|---|---|---|
| 1940 | 30,000 | 120,000 |
| 1945 | 45,000 | 180,000 |
| 1950 | 130,000 | 600,000 |
| 1954 | 160,000 | 850,000 |

(All figures exclude requirements of fighting services.)

Australian fuel oil demand in future years will depend largely on coal availability. In view of the effect of industrial disturbances upon production and transport and an increasing tendency to make good deficiencies in local production with imports from other countries when overseas supplies can be obtained, this is next to impossible. However, it is estimated that, should the development of coal production projects hold to schedule and the current situation obtain for the next few years, the Australian inland oil fuels market should exceed 2,000,000 long tons per annum by 1954.

**Lubricants—** From 1945 to 1951, automotive lubricating oil sales have more than doubled. Part of this increase is due to the lifting of war-time gasoline rationing early in 1950 and also to the great extension of civil aviation services, but the more significant influence has been the rapid growth in the car, truck and tractor fleets.

In the last two years, car registrations have been rising at the rate of 16-17 percent per annum, while truck and bus registrations have increased at 10 to 11 percent per annum, and agricultural tractors at 25 percent per annum.

The decrease in intensity in the use of older vehicles has meant that the increase in automotive oil consumption has proceeded at a slower rate than vehicles registrations, and currently it is rising at 12 percent per annum.

Demand for cars, trucks and tractors is still strong, but defense preparations have caused some decrease in supplies from overseas, especially in cars and trucks, and it is expected that this will cause the automotive lube-oil market to increase at the steady rate of seven to eight percent per annum through to 1954.

A buoyant market has also been experienced post-war for industrial lubricating oils, process products, greases and waxes. Here the growth has been largely due to the remarkable expansion of secondary industry. From 26,395 in 1938, the number of factories increased to 28,930 in 1945 and 41,588 in 1950. This has lifted the industrial lubricating oil and process market to 80 percent above the pre-war level. The process product market in particular is expanding rapidly and this will help to raise the total industrial lubricating market by about eight percent per annum through to 1954.

**Bitumen—** During the war little work on roads was carried out, apart from the construction of the military highways and the limited quantities of bitumen available were controlled by the Commonwealth Government. During December 1945 control of distribution ceased, importation under license through normal trade channels was resumed, and in 1946 the various road authorities embarked on extensive programs of maintenance and new road construction. In consequence, bitumen trade in all states rose sharply to pre-war levels.

Approximately 90 percent of Australian requirements of bitumen is used by state and municipal road authorities. Bitumen consumption since 1947 has not continued to show progressive increases each year because of shortages of labor and of road aggregate, and a tight supply position.

Prior to 1948, Australia's total demand for bitumen was met from overseas sources, but, with the opening of bitumen plants by Shell and Bitumen & Oil Refineries (Aust.) Ltd. and by the Vacuum Co. in 1949, the major part of Victorian and New South Wales requirements has been supplied from local production. Arrangements were made by the larger consumers in these states to accept delivery in bulk from these refineries direct to road site by specially designed pre-heated road tankers. Other states have continued to purchase bitumen mainly from overseas, owing to the paucity of suitable interstate shipping and the high interstate rail and road freight costs.

**LUBRICATING PRODUCT SUMMARY**
**(Barrels of 42 U. S. gals. or 35 Imperial gals.)**

| | Auto Lube Oils | Other Lubricating Products* | Total Lubricating Products |
|---|---|---|---|
| 1938 | 276,538 | 258,556 | 535,094 |
| 1939 | 351,007 | 347,979 | 698,986 |
| 1940 | 289,490 | 307,049 | 596,539 |
| 1941 | 283,474 | 373,071 | 656,545 |
| 1942 | 345,536 | 341,346 | 686,882 |
| 1943 | 336,781 | 338,118 | 674,899 |
| 1944 | 454,625 | 327,055 | 781,680 |
| 1945 | 340,829 | 282,121 | 622,950 |
| 1946 | 376,682 | 315,797 | 692,479 |
| 1947 | 490,908 | 387,640 | 878,548 |
| 1948 | 526,843 | 414,010 | 940,853 |
| 1949 | 592,279 | 455,583 | 1,047,862 |
| 1950 | 612,541 | 466,499 | 1,079,040 |
| 1951 Est. | 740,000 | 540,000 | 1,280,000 |
| 1952 " | 800,000 | 575,000 | 1,375,000 |
| 1953 " | 855,000 | 620,000 | 1,475,000 |
| 1954 " | 905,000 | 665,000 | 1,570,000 |

* Comprises industrial lubricants, process products, marine & railways oils, greases, and wax.

**NUMBER OF AGRICULTURAL TRACTORS IN AUSTRALIA**

| March | |
|---|---|
| 1939 | 41,943 |
| 1945 | 59,509 |
| 1946 | 66,183 |
| 1947 | 71,530 |
| 1948 | 76,336 |
| 1949 | 86,743 |
| 1950 | 104,430 |
| 1951 | 130,000 (Estimated) |

Note: In Australia there are 148,000 agricultural holdings producing crops.

**AUSTRALIAN AUTOMOTIVE REGISTRATIONS**

| | Cars | Commercial Vehicles | Total |
|---|---|---|---|
| 1938 (June) | 534,963 | 241,751 | 776,714 |
| 1945 " | 505,782 | 290,961 | 796,743 |
| 1946 " | 522,615 | 333,129 | 855,744 |
| 1949 " | 655,497 | 452,147 | 1,107,644 |
| 1950 " | 767,556 | 495,684 | 1,263,240 |
| 1951 (May) | 874,965 | 547,791 | 1,422,756 |

View of the Lagunitas field of I. P. C. in northern Peru. Photo courtesy International Petroleum Co.

By Dr. J. E. Rassmuss

# OIL DEVELOPMENT IN PERU

THE NEW Peruvian petroleum law described in previous reports* was approved in December by the House of Congress and has now been presented to the Senate for final action. The bill as heretofore described has been approved. Only article 147 has been changed, assigning to the Empresa Petrolera Fiscal a capital of 500 million S/ (about 33 million dollars) but this capital is to be provided by future taxes proceeding from the new oil law and by the profits of operation. It will therefore take some time before the activity of EPF can increase in a larger proportion and it will not be any obstacle to private or foreign enterprises. EPF may also constitute mixed companies together with private national capital.

Peru's oil consumption last year amounted to 8,540,000 barrels, or about 53 percent of the total production of 16,126,383 barrels, including casinghead gasoline and LPG. Demand increases every year about 12 percent, favored by the lowest gasoline price in the world, which amounts, including taxes, to only one sol per gallon (6.5 cents U. S.) leaving less than three cents U. S. to the producer. Exports of crude and principal refined products were 8,384,307 barrels, with refined products going mainly to Chile, Colombia and Bolivia, and about a million barrels of crude being shipped to the Ellesmere refinery in Great Britain.

International Petroleum Co's production decreased slightly to about 11.5 million barrels of crude in 1950, with 61 wells producing out a total number of 105. Production of Lobitos Oilfields, Ltd. increased from 2.6 to 3.2 million barrels of crude from 72 wells.

In 1951 total crude production of Peru amounted to 16,070,000 barrels, as against 15,028,000 in 1950—an increase of 6.7 percent. International Petroleum Co.'s production decreased to 11,347,000 barrels, but Lobitos Oilfields reached a new high of 4,349,000 barrels, an increase of 36 percent, providing 27 percent of Peru's crude output. Ganso Azul produced 164,000 barrels, while Empresa Petrolera Fiscal had relatively the highest increase of 50 percent to 210,000 barrels. Natural gasoline yield in 1951 was 1,086,000 barrels, and liquefied products including Hexan 32,000 barrels, giving a total production of petroleum products of 17,188,000 barrels, an increase of six percent over 1950.

The state-owned Empresa Petrolera Fiscal has developed noteworthy activity under the new government rule. Production from the Organos field is about 700 barrels daily from about 30 wells. In addition to cable tool rigs, one rotary is operated under contract in this field by the Santa Fe Drilling Co. of South America. In Zorritos three exploration wells have been drilled by Dunlap & Graham Inc. of Long Beach, Cal., to examine the oligocene Mancora sandstones below the Heath shales, which underlie the oilbearing Zorritos sandstones. Well No. 1, which reacned a depth of 6,894 feet, passed Zorritos, Heath and Mancora and found only salt water with a pressure of 4,000 psi. Well No. 2, with a depth of 5,485 feet, reached the granitic basement. Well No. 3, 4,603 feet deep, also touched the crystalline rocks. The Eocene formation, which contains the pay strikes in Talara and Lobitos, seems therefore not to extend to the Zorritos region. A fourth exploration well is located farther south at Punta Sal.

The adjoining northern region of Tumbes has been surveyed by a gravimetric group under contract with the John Hoard Geophysical Co. to define the depth of the basement. Also an aerophotographic survey of all the region has been executed by the Servicio Aerofotografico Nacional.

The crude, including the royalty from Lobitos Oilfields, Ltd., has been exported mostly to Argentina. The state refinery of Villar processed only 113,896 barrels during 1950 for consumption in the country. The new measure, because of the low top price of gasoline in Peru, has improved the position of EPF, which showed on Dec. 31, 1950 net earnings of 8,223,682 sols against 2,631,795 sols in the former year.

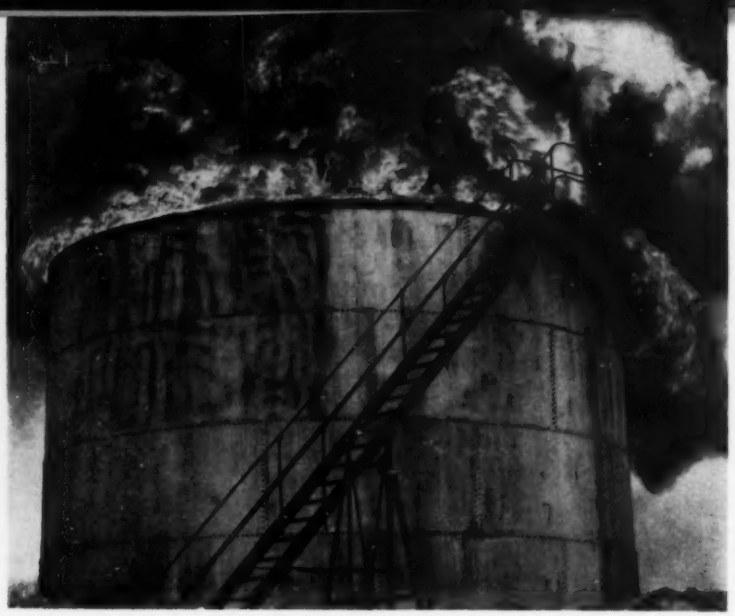
Lobitos Oilfields, because of improved drilling with new rotary equipment, increased its footage from 112,212 to 237,401 feet, or about 110 percent in 1950. Especially in the southern field in the Lobitos area, production increased substantially. In the southern boundary zone an agreement was arranged with IPC undertaking the development of this area on the basis of a division of the crude. Repressuring for a better recovery of oil, which is being successfully applied in IPC fields, is to be introduced in the near future. Although the company, according to the decree of the government, had to participate for the first time last year in a proportion of about 52 percent of its production for the local market, the financial results have been satisfactory.

In the Amazon basin the national Cia. de Petroleo El Oriente has continued its exploration at the Pisqui river, an affluent of the Ucayali river, about 100 kilometers northwest of Ganso Azul dome. The first well, Coninca No. 1, had to be abandoned at 4,650 feet because the drill pipe got stuck. The second well, Coninca No. 2, reached a total depth of 8,085 feet, being cleaned and drilling continued with 3½-inch drill pipe. It passed the lower limit of the tertiary Red Beds at 4,360 feet, entering further down the upper Cretaceous, passed the "Sugar sandstones" which are here developed in a shaly facies, the Chonta of 1,400-1,500 foot thickness, and finally the Huaya group, being now on the upper limit of the "Agua Caliente" series which contains the oil sands in Ganso Azul. At 7,710 feet an oil and gas show with water was found.

Ganso Azul Co. continues producing at a rate of about 450 barrels daily from its six flowing wells, selling its products in the Amazon region as far as Manaos in Brazil.

* See WORLD PETROLEUM, January 1952.

After 2½ minutes the tank was well ablaze. ▶



Gasoline was poured on surface of tank containing 100,000 gallons of kerosine to facilitate ignition of the oil. ▼

# NEW METHOD OF TANK FIRE FIGHTING

*Joe L. Risinger, who developed the new fire fighting method, began work in the Magnolia Petroleum Company boiler shop at Beaumont in 1919. He was made manager of fire and accident prevention in 1932 and transferred to the parent company's offices at New York in 1939.*

A NEW method of extinguishing and controlling oil tank fires has been developed by J. L. Risinger, safety superviser of Socony Vacuum Oil Co., Inc. The method has been tested in field storage and investigations are now being conducted to determine how it may be applied to tankers.

The method involves the injection of small quantities of compressed air at the base of the tank to create turbulence. Result is that the oil surface is cooled and the fire controlled or extinguished.

Fires in tanks containing kerosine, distillates or lubes are completely extinguished in a matter of seconds by the air injection method. Fires in tanks containing high gravity crude are brought under control quickly so that small quantities of foam may be applied and the fire put out. In either case the object of the method is to cool the substance to a point below or near its ignition point.

In the case of oils with flash points above atmospheric temperatures, this method is calculated to provide means of extinguishment with regular operating equipment available at locations where due to the infrequency of tank and other pool fires, heavy expenditures for fixed or portable equipment is not justified. In the case of crude oil and other oils with boil-over characteristics, the objective of the new step is to eliminate these hazardous probabilities and in addition make extinguishment of such fires possible with much less material and equipment.

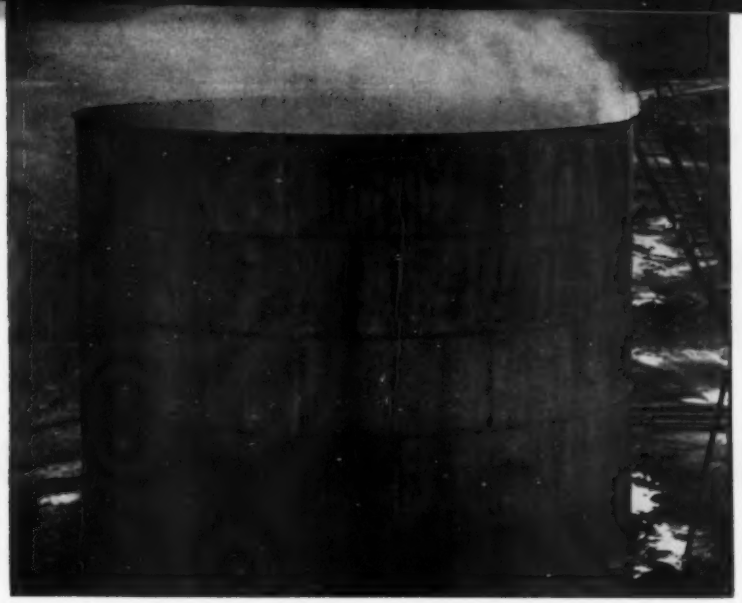
An accompanying series of photographs illustrates recent field tests made at Socony's Olean, New York refinery where an old 30 X 30-foot open top storage tank was available. The tank was equipped with conventional devices for water draw-off, a product line, and devices for steaming out the tank or agitating its contents. Air was obtained from a portable plant compressor for injection into the standard tank connections.

In the first test, 100,000 gallons of 47.4 gravity kerosine distillate was pumped into the tank over a 9-inch water bottom. The tank was ignited and permitted to burn for 2½ minutes. When it was well ablaze, air was injected at the rate of 50 cubic feet per minute at 7 psi.

When air was injected into the three-inch water draw-off at one edge of the tank near

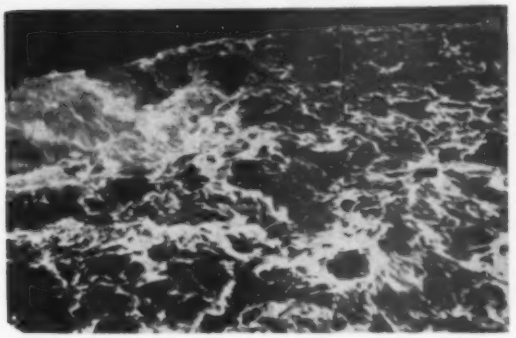
◀ Tank on fire after substituting 44 gravity crude for kerosine.

▼ As fire was diminished by air injection the tank and stairway were sprayed with water so that observers could mount to the rim.



◀ In a series of tests, the blaze was put out in from five to 30 seconds by injecting air at the bottom of the tank to induce turbulence.

▼ Surface turbulence of kerosine after fire was put out.



the bottom, fire was put out in 30 seconds. A second fire was extinguished in 35 seconds when air was introduced through a perforated steam line across the center of the tank base. The third fire was extinguished in 20 seconds by injecting air into a spider. Test No. 4 was made by injecting air through a shell ell which induced a circular turbulent motion without the effective surface cooling of other methods. Result was that it required 45 seconds to put out the fire. Final test was made by injecting air through an ell extending upward from the center of the tank near the bottom. This method caused a hill-top effect at the surface of the oil with a rapid flow of cold oil from the center to the circumfere ice. With this method the fire was out in five seconds. Only 6 1/4 cubic feet of air was required to extinguish the fire.

Conclusions reached were that any fire in bodies of oil with a flash point above atmospheric can be extinguished quickly and safely by injecting air below the surface in such a manner that the movement of cold oil to the hot surface reduces the temperature at that point. Any source of air is acceptable and any line entering the lower portion of the tank is usable. While no tests were made at Olean, it is the belief of Mr. Risinger that it would be easy to extinguish the fire by pumping in cold oil instead of injecting air. In an open pit, a kerosine fire was extinguished by squirting in more kerosine to cool the surface.

Following completion of the kerosine tests, the tank was emptied and refilled to three fourths capacity with 44.2 gravity Pennsylvania crude oil with a flash point below zero. After igniting the oil and permitting it to burn freely, air was injected through the various lines mentioned above. Result was that the fire was reduced to a point where it was possible for observers to climb the tank stairway, peer over the rim and extinguish the fire with two 5-gallon pails of three percent foam solution injected from one 1 ½-inch mechanical foam nozzle. Before foam was applied, the tank was permitted to burn freely five times as different methods of air injection were tried. The stairway and shell adjacent to the platform was sprayed with water to reduce the metal temperatures so that observers could mount the stairway safely and comfortably to inspect the surface of the crude while it still was burning at a controlled rate.

A primary purpose of the Olean tests on crude oil was to see how air could be used to prevent boil-overs and slop-overs. Boil-overs are caused by heat waves from the surface descending through the crude in a tank until water at the base is converted to steam and an eruption is caused. Application of large amounts of water or foam to the surface of a tank of burning crude causes an expansion and frothing near the top which pushes some oil out, although not as much as when a boil-over occurs.

To watch the heat wave during the crude burning tests, the tank was painted with a heat detecting paint. It was found that during the period that air was injected there was no downward movement of heat through the oil. Preliminary tests indicated that a heat wave in the crude being burned would travel downward from the surface at about 48 inches per hour. During the course of the various tests, the wave would have traveled 100 inches. Actually the heat wave traveled a half inch during each pre-burn, but the downward move was halted as soon as air agitation commenced. There was no frothing when foam finally was applied at the end of the tests.

Flames burning off light vapors from agitated crude before fire was extinguished with foam. ▶

Observers watch burning of crude in tank under control with injected air. ▼

# GEOLOGY

## OF THE WILLISTON BASIN

By Wilson M. Laird

State Geologist, North Dakota Geological Survey, University of North Dakota

*The first part of Mr. Laird's study of the Williston Basin appeared in the January, 1952, issue of WORLD PETROLEUM. A discussion of test wells which have been completed to date was included in this part.—Editor*

INASMUCH as much of the information relative to the stratigraphy of the Williston Basin will vary from time to time as more information comes to light, it should be borne in mind that the descriptions given in this article as to thickness and detailed lithology may later be proven to be inaccurate. In any event, all conclusions drawn are tentative.

The Cambrian extends apparently only a short distance in the state. The only well where it has been positively identified is the Carter N. P. No. 1 well in Fallon County, Montana. Seager[1] notes that it consists largely of interbedded green shale and dolomite overlying a basal glauconitic sandstone. However, some observers would place the very heavy glauconitic sand which is found at the base of the Winnipeg sandstone over much of the eastern two-thirds of North Dakota in the Cambrian. This is done primarily on the basis of its similarity in lithology to the Deadwood sandstone of the Black Hills in South Dakota.

The Ordovician is one of the most extensive of the Paleozoic formations in North Dakota. Practically every well drilled deep enough has penetrated it. There are three Ordovician formations found from the base upward: the Winnipeg formation, the Red River formation, and the Stony Mountain formation. The exact dating of these particular formations in terms of standard sections is not known. They are probably all of the Upper Ordovician age although some of the basal ones might conceivably be Middle Ordovician.

The Winnipeg formation varies in thickness from 100 to 535 feet and consists largely of green gray shale, some sandy limestone and gray limestones. The sand in the basal part of the Winnipeg formation has been mentioned previously as having excellent permeability and porosity and is found rather largely in the south-central and eastern parts of the state. Its development to the north and west is as yet not known because no well has penetrated that deep in North Dakota. Overlying the Winnipeg is the Red River formation consisting of 138 to 600 feet of gray to tan, dense to granular dolomite and sandy limestone. These limestones frequently have some zones of porosity of considerable interest to the oil prospector. As yet no live oil has been encountered in them. Overlying the Red River is the Stony Mountain formation from 100 to 500 feet in thickness, consisting largely of dolomitic limestone and shale. In Manitoba this formation on the outcrop consists of as much red and green shale as interbedded limestone. This formation in both the outcrop and the wells is very fossiliferous.

The Silurian in North Dakota had not been positively identified until recently when more extensive surface and sub-surface studies were made. It is, however, thought now to be approximately co-extensive with that of the overlying Devonian. There is some question as to whether or not the oil found at 11,630 to 11,660 in the Amerada Petroleum Corp. Clarence Iverson No. 1 well may not be coming from rocks of Silurian age. The Silurian usually consists of a dense, earthy-appearing white or pale-colored dolomitic limestone with relatively little or no porosity in the wells which have been drilled. On the other hand, however, in the outcrop of Manitoba, biostromal conditions have been noted in a number of areas and quite likely these extend into the sub-surface in North Dakota. The Silurian system in North Dakota varies from 0 to a questionable 300 feet in thickness, although this greater thickness may be incorrect.

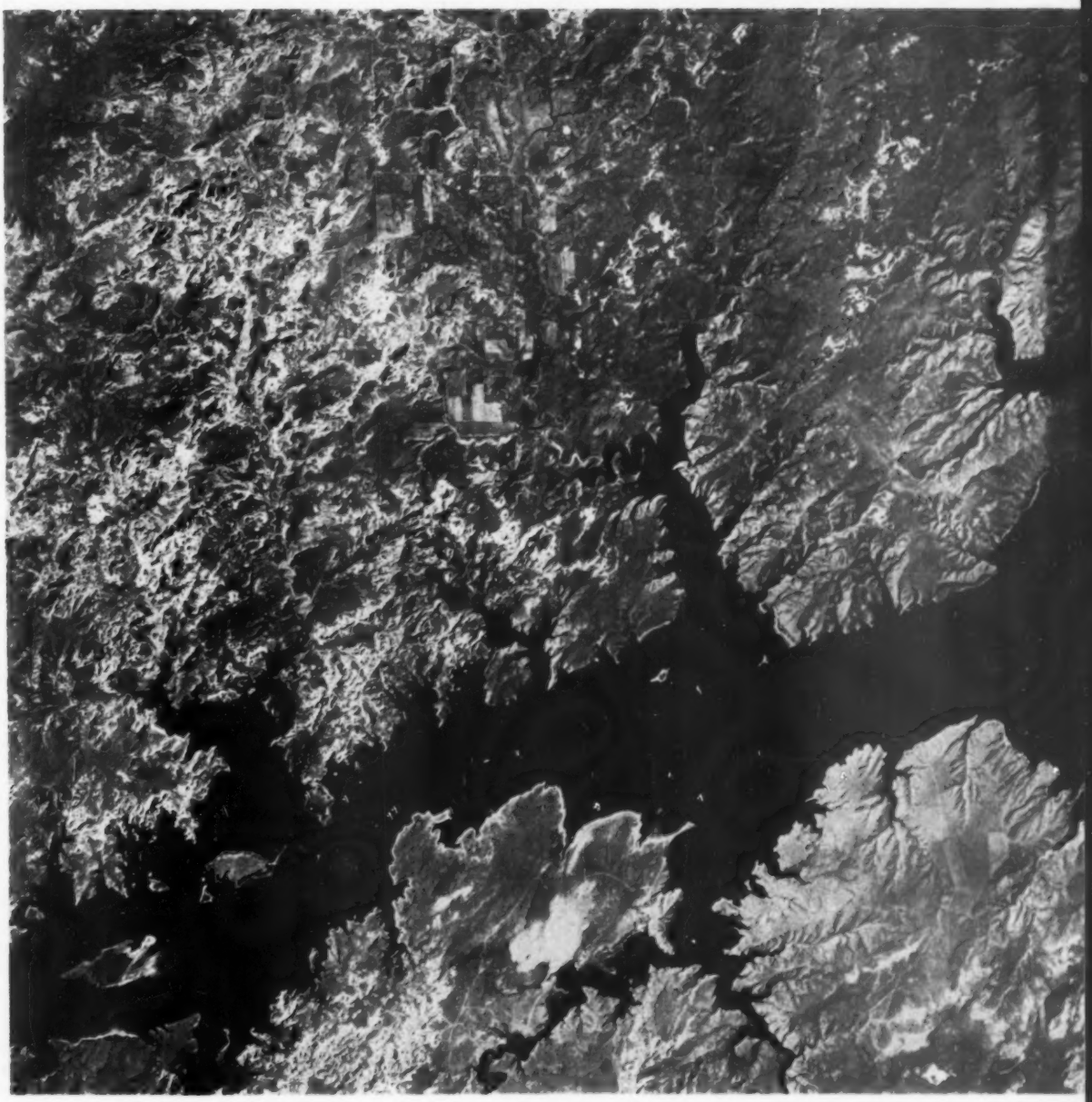
The Devonian in North Dakota has unquestionably been one of the most interesting formations of all from the standpoint of oil occurrence. It is, of course, of interest because of its prolific production of oil in other parts of North America, particularly Alberta. In Alberta, however, the rocks are of Upper Devonian in age. The age of the rocks in North Dakota is not so well known, although it is thought in the western part of the state both Upper and Middle Devonian rocks are present whereas in the eastern part of the state quite likely the rocks of the Devonian are largely Middle Devonian in age.

One of the interesting geologic features in the Devonian is the presence of reef structures. Reefs are well known in the Devonian in Alberta. Reefs are also well known in the Middle Devonian of Manitoba.

The Devonian sedimentation is inaugurated by the deposition of the Ashern formation. There is some question as to the exact age of the Ashern inasmuch as some people would place it in the Silurian. However, the present

[1] Seager, O. A., *Stratigraphy of North Dakota*, Am. Assoc. Petroleum Geol. Bulletin, Vol. 26, pp. 1414-1423, 1942.

# IN NORTH DAKOTA—PART II



Fort Peck Reservoir area, one of several thousand new aerial photographs of the Williston Basin region recently taken by Aero Service Corp., Philadelphia.

writer would prefer, on the lithological basis of its occurrence in Manitoba, to place it in the basal Devonian even though there is no fossil evidence to substantiate this conclusion at present.

Overlying the Ashern is the Elm Point limestone which consists of 0 to 60 feet of very thin, dense, mottled limestones with saccharoidal texture.

Overlying the Elm Point is the Winnipegosan formation which varies from 0 to 660 feet in thickness. This is chiefly a dense to saccharoidal dolomite and some limestones. It is the formation in which reefs are extensively developed in Manitoba, and in general it has a good potential from the standpoint of oil accumulation because of its porosity and permeability.

Overlying the Winnipegosan is the Manitoban formation consisting of a buff to slightly pinkish mottled limestone with some dolomite and anhydrite. It varies from 0 to 250 feet in thickness in North Dakota. At the surface in Manitoba it contains a basal red limestone and dolomite sequence. Whether this sequence can be found in the subsurface in North Dakota is somewhat doubtful.

In the subsurface it is difficult if not impossible to differentiate the Winnipegosan and the Manitoban. The fairly distinctive lithology at the surface becomes intermixed in the subsurface so that in the subsurface this unit should probably be referred to as Manitoban-Winnipegosan until more data is available.

Of the other Devonian formations, especially in eastern North Dakota, one of interest is a red dolomitic shale and dolomite sequence which is known as the Lyleton formation.[2] This is probably of Upper Devonian age based largely on its stratigraphic position.

In the wells which have been drilled in the western part of the state, notably the Amerada's Clarence Iverson No. 1, it would appear that beneath the Lyleton formation is a lithologic sequence—probably of Upper Devonian age based on the fossil content. These rocks consist of dark brown dolomites and limestones both dense and saccharoidal in texture. This dolomite and limestone lithology is suggestive of Jefferson type Upper Devonian lithology in Montana, but does not extend much east of the central part of North Dakota if it extends that far.

It should be noted that rocks of Middle and Upper Devonian age are not coextensive in the northern Great Plains and northern Rocky Mountain areas. In Montana no rocks of Middle Devonian age are known at the surface. Therefore, it would appear that the Middle Devonian lenses out before it gets to or very close to the North Dakota-Montana boundary, and most of the upper Devonian passes out of existence in an eastward direction somewhere in central North Dakota with the exception of the Lyleton formation.

One of the interesting things found in the Clarence Iverson well is the presence of a very extensive salt bed at the top of what has been called Middle Devonian in North Dakota. These salt and evaporite beds are noted to be extensively developed northwestward into Saskatchewan, but the exact date of the saline beds has not been satisfactorily determined in either place. It is known that Upper Devonian fossils occur above the salt and that Middle Devonian fossils are found below the salt.

At the basal part of the Mississippian in North Dakota is the Englewood formation. This formation makes an excellent marker bed because of its distinctive lithology consisting largely of 25 to 110 feet of dark carbonaceous shale, some green-gray shale, a little limestone, and occasionally a fine siltstone or sandstone. This sandstone is apparently the rough equivalent of the Banff sandstone in Alberta and the black shale as a whole is probably roughly equivalent to the Chattanooga black shale interval known so widely in the rest of the United States.

[2] Allen, J. D., Kerr, Lillian B., *Oil and Gas Exploration in Manitoba*, The Pre-Cambrian, pp. 1-4, 1950.

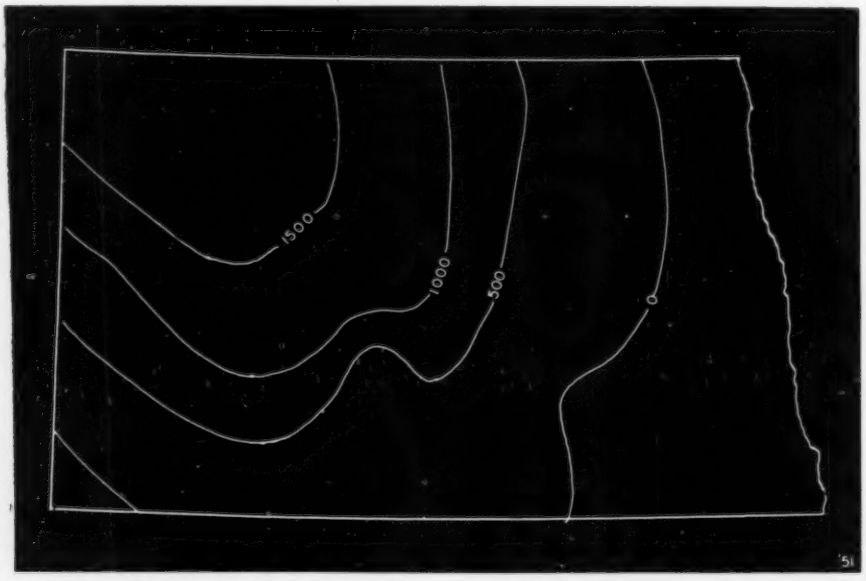



**Fig. 1. Isopach map of the Devonian in North Dakota.**

Overlying the Englewood formation is the Madison group consisting of two fairly distinct formations: the Lodgepole formation below and the Mission Canyon formation above. The Lodgepole consists of from 75 to 880 feet of gray to buff, granular to dense limestones and considerable chert, especially in Montana. This is the thicker of the two formations of the Madison group, and fortunately from the drilling standpoint, the chert is not so common in North Dakota as it is in Montana. The Mission Canyon formation consists of 80 to 530 feet of fragmental, buff to tan, light tan limestones which frequently are cavernous at the surface. The upper part of the Mission Canyon is where the vugular porosity and fracturing occur in which oil has been found in several of the wells mentioned previously.

Overlying the Madison group is the Big Snowy group, the basal member of which is the Charles formation. This formation consists of a section of dolomitic limestones, anhydrites and some shales from 550 to 890 feet in thickness. There is some question in the writer's mind as to whether or not the Charles might not be a part of the Madison group or in other words a facies of the Madison formation which is not seen at the surface. The Charles does have some porosity and, therefore, is of considerable interest from the standpoint of a potential reservoir rock.

Overlying the Charles is the true base of the Big Snowy group in the writer's opinion. At the base of this is the Kibbey sandstone, resting with considerable unconformity on the upper part of the Madison in central Montana where it crops out. The Kibbey is from 0 to 350 feet thick and consists of variegated shales with red and grey sandstones near the base. These sandstones are poorly sorted and probably would not make a good oil-bearing horizon. However, oil has been reported from this horizon in Montana.

Overlying the Kibbey are the Heath and Otter shales. On the surface the Otter is an excellent marker because of its bright green color. In North Dakota, however, it is difficult if not impossible to separate the Otter from the overlying Heath. The Otter is from 0 to 310 feet while the Heath varies from 0 to 335 feet in thickness. The Heath consists largely of black carbonaceous shales, some gray to green shale, and some dolomite. Some lenticular sandstones are present in the Heath and have produced a little oil in Montana. There is question as to whether or not the sand extends to North Dakota, but as yet its presence has not been proven.

Overlying the Heath is the Amsden formation which is considered to be of Mississippian age in North Dakota. The Amsden varies from 0 to 250 feet in thickness and consists rather largely of orange and purple dolomites, limestones, and shale. The Amsden is placed by the author in the Mississippian because of the faunal evidence derived from this formation in Montana. There seems, however, no question about the fact that as it is traced farther into Wyoming, the upper part at least is Pennsylvanian in age.

The Pennsylvanian formations are not thought to be present very extensively in North Dakota, and they are found only in the southwestern corner of the state where the Minnelusa formation has been identified in the Carter N. P. No. 1 well where it is about

300 feet in thickness. This formation consists of white anhydritic sandstones and limestones.

The Permian, like the Pennsylvanian, is poorly developed in North Dakota. In the Carter N. P. No. 1 well in Fallon County, Montana, it consists of two formations, the Opeche at the base and the Minnekahta above. The Opeche consists of 88 feet of red shale and anhydrite and the Minnekahta formation consists of 40 feet of purple dolomite and limestone.

The Triassic is the basal formation of the Mesozoic era in North Dakota. It rests with considerable unconformity on all formations from the Permian through the Silurian. It may also lie on the Ordovician depending upon the identification of some portions of the section in the north and eastern part of the state. In North Dakota the Triassic is represented by the Spearfish formation which consists of 0 to 895 feet of reddish medium to fine-grained sandstones with some red and gray, silty shales. Some gray and black shales and anhydrites may also be present. No fossil remains have been found in this formation in the subsurface, and therefore, it is somewhat difficult to differentiate this formation from similar lithology in the basal part of the Jurassic lying immediately above it.

The basal Jurassic in North Dakota has been called the Sundance by some, but the writer would prefer to call it the Ellis formation. In central and northwestern Montana the Ellis consists of three formations. Starting from the base upward, these are the Sawtooth, the Rierdon and the Swift. The Sawtooth formation in central Montana is the thickest and contains a very definite evaporitic sequence including limestones, anhydrites, and shale.

Overlying the Sawtooth and at the base of the Rierdon is an oolitic limestone and a micro-conglomerate which is quite consistent over North Dakota, making an excellent marker bed. It is in this approximate horizon that the recent discovery of the Socony Vacuum Exploration Co. in southwestern Saskatchewan was made where a large gas flow was encountered. Inasmuch as this particular horizon has a fair porosity and permeability, it should not be overlooked as a potential oil reservoir.

The Rierdon is largely a black and gray shale sequence with some oolitic and dense limestones. It is difficult in North Dakota to differentiate the Rierdon from the overlying Swift. The Swift in central Montana normally is a sandstone sequence. However, as the Swift is traced eastward, it becomes more and more shaly, and appears at the surface and subsurface more like the Rierdon. The total thickness of the Ellis formation in North Dakota varies from 90 to 895 feet in thickness.

Overlying the Ellis is the Morrison formation consisting of gray, green and variegated shales and shaly sandstone. It varies from 0 to 260 feet in thickness. It is somewhat difficult to distinguish in the subsurface from the overlying beds of the Dakota group, but it has been so differentiated in a number of wells.

The Cretaceous of North Dakota is largely upper Cretaceous in age and is inaugurated by a group of sandstones and shales which have usually been called the Dakota group. Recent authors[3, 4] would term this group the Inyan Kara group and would discard the term Dakota altogether. They also would place this group in the Lower Cretaceous. Their terminology would be, starting from the base, Lakota sandstone, Fuson shale, Fall River sandstone. It would appear that in North Dakota the formation usually called the Dakota sandstone would probably be correlative with Rubey and Crowley's Fall River. Crowley places the whole Inyan Kara group plus a part of the overlying sequence (Skull Creek and Newcastle (Muddy)) in the Lower Cretaceous. Rubey places the top of the Lower Cretaceous and the Inyan Kara group questionably at the top of the Fall River sandstone. Inasmuch as this formation is not exposed at the surface in North Dakota, and inasmuch as the age of the faunal and floral assemblages found therein have not been adequately determined, it would appear that a definite age cannot be assigned to these formations in North Dakota at the present time. Furthermore, as the Dakota group was apparently deposited in an eastward transgressing sea, the age of the formation might be expected to be somewhat younger in North Dakota than in the Black Hills.

The Dakota group consists rather largely of clean white to dirty gray sandstones and some interbedded gray shales. It is difficult to separate some of these formations down into the Lakota, Fuson, and Dakota as has been done by several authors. The Dakota in the eastern part of the state is reported to be arkosic in nature. Usually in rotary drilling the drill is going so fast through this and the overlying Cretaceous shales that it is difficult to collect adequate samples.

Some small amounts of gas have been associated with the water from the Dakota sandstone which is much used in the southeastern corner of North Dakota and the northeastern corner of South Dakota. However, no gas in commercial quantities has as yet been encountered in the Dakota group in North Dakota.

Above the Dakota or Fall River sandstone is an interval of about 200 feet of gray shale directly underlying a sand and shale sequence tentatively identified with the Muddy sand. This formation varies from 0 to 90 feet in thickness, and it apparently lenses out rather rapidly eastward from the center of the basin. This particular horizon might possibly contain oil and if the stratigraphic conditions were correct, it would make a good reservoir rock. It would appear that this formation deserves more consideration than it has been given to date.

Above the Muddy sand sequence is a thick section of 90-1360 feet of dark gray to almost black, usually non-calcareous shales. About 450-500 feet above the Muddy is an indefinite limestone sequence usually identified as the Greenhorn. It frequently contains abundant *Globigerina* and makes a decided kick on the resistivity log. In some wells some sands have been logged in the upper part of the Greenhorn. These are probably equivalent to the Turner sandy member or the Frontier formation of the Carlile shale.

Overlying the Carlile is the Niobrara formation from 80 to 800 feet in thickness and consisting largely of gray shale with very calcareous shale or "cement" rock at the top. The Niobrara is known at the surface in the Pembina Mountains in North Dakota as well as along the Sheyenne River in North Dakota in the central part of the state. In the "cement" rock part of the formation are a number of microfossils, notably *Globigerina*. The zones containing the *Globigerina* are sometimes called the white speckled zones, and there appear to be several such in the Niobrara. Whether or not these zones can be

[3] Rubey, W. W., *Lithologic Studies of Fine-grained Upper Cretaceous Sedimentary Rocks of the Black Hills Region:* U. S. Geol. Survey Prof. Paper 165, p. 4-5, 1931.

[4] Crowley, A. J., *Possible Lower Cretaceous Uplifting of the Black Hills, Wyoming, and South Dakota:* Am. Assoc. Petroleum Geol. Bull. 35, pp. 83-90, 1951.

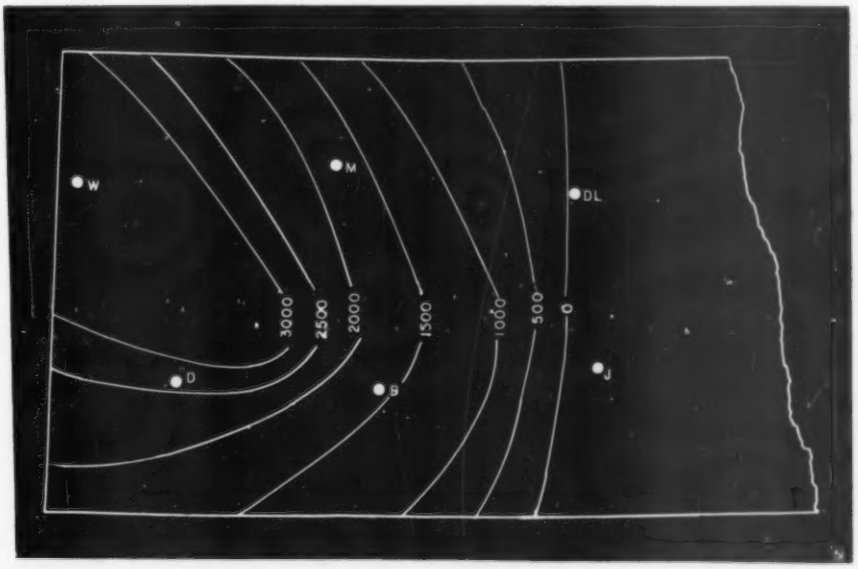



Fig. 2. Isopach map of the Mississippian in North Dakota.

used as marker beds is not yet fully determined due to lack of study.

Overlying the Niobrara is the Pierre formation which averages from 930 to 2300 feet in thickness. It is an extensive gray shale sequence which is not particularly fossiliferous. At the base of the outcrop in the northeastern part of North Dakota in the Pembina Mountains is a bed which is known as "fuller's earth" which appears to be a badly leached shale perhaps originally bentonitic. Whether or not this can be found in the subsurface is not known, although there is some indication that it may be. It has been traced from the surface at the Pembina Mountains far north into the Riding Mountains and even further north into the province of Manitoba in Canada. At the upper part of the Pierre and near the base of the Fox Hills is a concretionary zone which is more or less transitional to the basal part of the Fox Hills formation. This concretionary zone is frequently very fossiliferous, especially with *Discoscaphites* and other fossils such as *Inoceramus*.

The Fox Hills formation overlies the Pierre and represents the last great Cretaceous inundation of the continent. It consists largely of gray glauconitic sandstones and interbedded greenish-gray marine shale. In thickness it varies from 180 to 320 feet and in the central part of the state its outcrops are best known in the area around Linton. It is also found in the east side of the Baker-Glendive anticline in the western part of Bowman County in southwestern North Dakota.

Overlying the Fox Hills formation is the Hell Creek, which is the last formation of the Cretaceous found in North Dakota. The Hell Creek is largely a continental sequence consisting mainly of fine-grained argilaceous sandstones, lignitic shales, and some thin lignites. In thickness it varies from 100 to 575 feet. One member of this particular formation is of interest from the standpoint of the fact it indicates the transitional nature of the contact between the Fox Hills and the overlying Hell Creek. In the central part of Morton County and in the northern part of Sioux County is a small marine member known as the Brien member. This apparently marks a very minor marine incursion immediately after the beginning of Hell Creek time. It is apparently only an estuarine type of deposit and probably marks a readvance from the "Fox Hills" sea to the south. The Hell Creek formation is characterized by non-marine fossils, notably the remains of the dinosaur *Triceratops*.

The Paleocene is inaugurated in North Dakota by the beginning of the deposition of the Fort Union group. At the base of the Fort Union group is the Cannonball formation which grades westward into Ludlow. The Cannonball is a marine sequence and the Ludlow is a continental sequence. From the Missouri River westward for about 50 miles the Cannonball formation is found well-developed, particularly along the Cannonball River. It consists largely of marine sands interbedded with dark gray marine shales. As this formation is traced westward, the gray marine shales become continental in nature and contain lignite. This continental sequence is called the Ludlow formation. The westernmost known extent of the Cannonball formation is on the Little Missouri River in Slope County near a locality known as Yule. The Ludlow averages from 0 to 250 feet in thickness, and the Cannonball varies from 0 to 300 feet in thickness.

Overlying the Cannonball-Ludlow sequence is the Tongue River formation varying in thickness from 200 to 800 feet. This thickens in a westward direction. The top is seldom seen in view of the fact that there is a considerable erosional disconformity which separates the top of the Tongue River from the overlying formation. Furthermore, the Tongue River constitutes the surface formation over much of western North Dakota, and therefore, is subject to considerable erosion. It consists rather largely of light- to dark-colored calcareous shales and sandstones and lignite. It is the main lignite-bearing formation of North Dakota.

The Eocene is represented in North Dakota by the Golden Valley formation which varies in thickness from 0 to 200 feet and consists rather largely of a light-colored clay ash sequence at the base known as the "marker bed." Overlying this is a sandstone sequence in which the sands are rather fine-grained and micaceous. This formation rests with considerable disconformity on the top of the Tongue River and it makes a good "key" bed wherever found.

The White River formation of Oligocene age overlies the Golden Valley formation. The White River consists of an erratically-occurring formation of 50 to 200 feet in thickness characterized by a variety of lithology, notably shales, clays, limestones, and sandstones and some conglomerates. It caps only some of the higher buttes in the western part of the state. It extends from Bowman County northward into McKenzie County. It is characterized in some places by fossil remains, particularly by the fossil *Oreodon*.

Most of the eastern and northern part of the state is overlain by a sequence of glacial drift, probably in a large part of Wisconsin age. The glacial deposits of the area southwest of the Missouri River are probably somewhat earlier in age than those of the area east of the river. Not all of the area southwest of the river is covered by glacial deposits. The area south of the Missouri is regarded as belonging to the Iowan age whereas the material east of the river is probably Tazewell and Mankato in age. In the southwestern part of the state the till is not sufficiently thick to cause much derangement of drainage or alteration of the topography. In the rest of the state east of the river the glacial interval interrupted the topographical history of the state so that very little of the pre-glacial is seen.

It would appear from the study of the subsurface geology of the state that there are a number of beds which can be considered as potential oil-producing horizons. All of the periods of the Paleozoic, particularly the Ordovician, Devonian, and Mississippian, may be potentially capable of producing oil and gas in some quantity. This potential should best be realized where Devonian reefs are developed and where the Mississippian unconformity occurs in the eastern half of the state. Mississippian production is known also in other parts of the state some distance removed from this unconformity.

Beds of the Mesozoic, notably those of the Jurassic and in the lower part of the Cretaceous, should not be neglected from the oil standpoint.

Very little is known about the subsurface stratigraphy of the state, everything considered, in view of the fact that there are less than forty-five wells drilled. Much more drilling must be done before it can be said that we have an adequate picture of the subsurface stratigraphy. Much awaits further prospecting, both geophysical and geologic. It would appear, from the present standpoint at least, the most important type of prospecting with the best hope of results will be that of seismic prospecting.

All in all, the future of North Dakota from the standpoint of oil and gas occurrence looks bright.

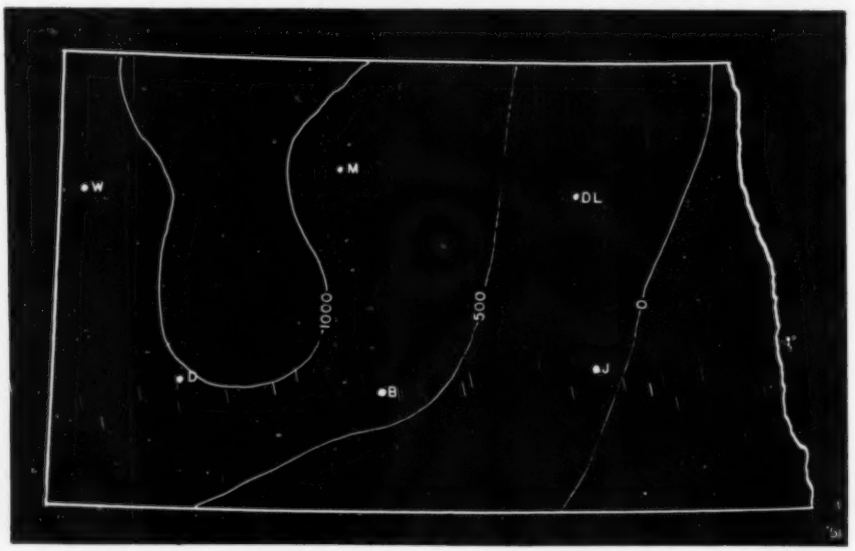



Fig. 3. Isopach map of the Jurassic in North Dakota.

# Changes in PAD Staff Presage No Shift in Operating Procedure

By Joseph Huttlinger

TURNOVER in the personnel of the Petroleum Administration for Defense is a more or less continuing process as men who have been serving on leave from their organizations return to their regular jobs and recruits are drafted to take their places. Changes in the immediate future will be numerous as a number of men in key positions who agreed to serve for a year have reached or are nearing the end of their terms.

The two top men of PAD who have been in command from the start are still at their posts. They are Secretary of the Interior Oscar L. Chapman, who is Petroleum Administrator for Defense, and Bruce K. Brown, Deputy Administrator. Brown, the actual operating head of the agency, is serving without compensation, on leave from Pan-Am Southern Corporation. Brown's service is nearing its end. It already has been announced that he will be succeeded by J. Ed Warren of Midland, Texas, who is affiliated with the producing firm of King, Warren and Dye. Warren, who has been president of the Independent Petroleum Association of America for the past two years, is to come to Washington next April and take Brown's job on June 1.

The important production division obtained a new director with the start of the year. He is Robert L. Foree, for years active in the Texas Independent Producers and Royalty Owners Association.

Foree succeeded Richard G. Lawton, president of Lawton Oil Corp., Magnolia, Ark., who served a year, and then went back to his company. Perhaps as a reward, he has been named a member of the National Petroleum Council, chief industry group advising the government, which is composed of prominent oil and gas executives.

The materials division, perhaps the key unit in view of the vital importance of material supplies to the industry's operations, is under the direction of Richard M. Morrison, who left his post as manager of Texaco's purchasing division in New York to help out. Morrison followed Frank A. Watts of Houston, Texas, sales manager of Humble Oil & Refining Co., who set up the basic operating procedures, and waged the early fights for steel allocation.

A third major unit, the oil supply and transportation division, has just acquired its third director in the person of Charles E. Spahr of Cleveland, vice-president in charge of transportation for Standard Oil Co. (Ohio). He is to serve without compensation. Spahr takes over from George A. Wilson, who is returning to Interstate Natural Gas Co. The first director of the division was Dene B. Hedges, on leave from Shell Oil Co. in New York.

C. E. Davis, vice-president of Shell Oil Co., is director of the refining division, but moves up to become assistant deputy director of PAD for domestic operations about April 1. He is to succeed A. P. Frame, who wants to return to his position as vice-president of Cities Service Oil Co. after 18 months with the defense agency.

William Keeler of Phillips Petroleum Co., Bartlesville, Okla., is to join PAD shortly for grooming to head up the refining division.

C. P. Rather, president, Southern Natural Gas Co., Birmingham, Ala., is still serving as assistant deputy administrator for natural gas transmission and distribution, but getting restless. C. S. Snodgrass, from Bechtel, is the director of foreign operations and an assistant deputy director; he is looking toward getting back to private business. Cecil L. Burrill, director of the program division and on leave from Creole Petroleum Corp., remains in charge after more than a year in that position.

The petroleum agency, unique because it has issued but four directives in a year and a half of handling operations of one of the world's greatest industries, recently gave forth an illuminating bit of philosophy. In a letter to defense agencies, it said it saw no merit in "rationing shortages," but preferred to get the materials needed so oil and gas can "avoid" shortages.

It is not anticipated that the changes taking place among the directing heads of PAD will lead to any marked changes in its operations. The general feeling in Washington is that the agency has been very efficiently organized by Bruce Brown and his associates, that the big job has been accomplished and operating procedures set fairly well. The job ahead appears to be one of keeping things on an even keel. Whether or not this proves difficult appears to depend chiefly upon the supply of materials. There is assurance that the situation is easing, and some go so far as to say that shortages of oil country tubular goods, so far as they now exist, will be over by midyear. With new steel capacity coming in, other shortages should be relieved. One uncertainty always remains: the government could at once create new shortages by hiking the goals on military and defense programs.

On the much-debated question of steel supply both sides appear to be right—to a certain degree. The steel men maintain there will be a substantial increase in output. From the viewpoint of PAD and members of the oil industry, there is a prospective shortage in comparison to the quantity they would like to have and really need to put their industry on a sound footing. For example, PAD is figuring on the drilling of 44,000 new wells in 1952, but would like to raise the figure to 50,000 if there were a chance of getting sufficient material. Similarly, some deserving pipe line projects are being laid on the shelf because of the practical certainty that DPA cannot find steel for them.

The situation in the refining industry was depicted by Cecil L. Burrill, director of PAD's program division, in an address on January 14 when he said, "The solution of the problem of refining capacity is the allocation of more steel to the refining industry. PAD is developing a new refinery expansion program which calls for the construction of 475,000 b/d of new refinery capacity per year. This compares with the present program of 330,000 b/d per year which is not being fully achieved for lack of materials. In PAD's opinion, the refining industry would build 475,000 b/d per year if the steel and other materials were made available." In other words, no matter how much steel production may expand in 1952, all its output and more will be needed.

With Congress back in Washington, but not yet settled to its legislative tasks at this writing, it is impossible to foretell what bills affecting the oil industry will come up for serious consideration. A prospect that appears more certain is that a series of investigations into various phases of petroleum operations will be launched during the next six months of this politically conscious session.

Charges publicized by Elmer Patman, a Texas attorney, that a powerful international cartel plans to crush independent oil operators in the United States, may be taken up by the small business committee of the House as affording opportunity for some political haymaking this presidential year.

The supply and distribution of steel, depletion allowance, tidelands, overall fuel policy involving possible adoption of end use controls favoring coal, import duties, tanker rates, and divorcement legislation have been proposed as fields of study.

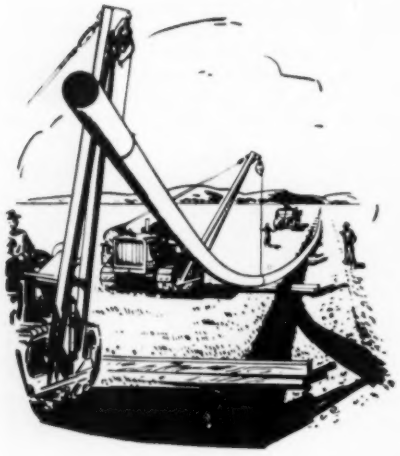
The House ways and means, small business, judiciary, commerce committees and the Senate interior and insular affairs committees may be among those chiefly concerned with the studies.

There is a possibility that a two-year study by the Federal Trade Commission dealing with the operation of American oil companies abroad may be sprung as a potential political sensation. The report is said to have been circulating in high administration circles under the label "secret." It is alleged to be liberally sprinkled with the words "cartel, monopoly, price-fixing," and others in a similar vein, and to call for legislation. The study was made under the direction of Dr. Corwin Edwards, head of the commission's bureau of economics. Whether it will be made public or not appears still uncertain.

Another controversial subject, that of import duties, is discussed in a U. S. Tariff Commission report which, at this writing, is held secret by President Truman. Official reason for the secrecy is reportedly that it might affect current United States-Venezuela talks about revision of oil import duties. Expectation has been that these talks, begun last year, would bring the duties somewhat lower than they now are. The present duty is 10.5 cents a barrel for a volume of imports up to five per cent of the previous year's refinery runs, and 21 cents a barrel after that.

# Gas Export Will Bring Millions To Canada

By J. L. Irwin



FOR THE past several years the question of gas export from Alberta has been a subject of discussion, the term export being applied to any shipment beyond the borders of the province. In 1949 the Dinning Commission made a report on the subject. In the following year an interim report was made. In January, 1951, hearings were held before the Alberta Conservation Board, and again in September of that year, applicants for permits to export gas appeared to present their submissions to the board. Meanwhile, in the period between the interim report in 1950 and the present time, the estimated natural gas reserve of Alberta has increased from 4,439 billion cubic feet to around 8,000 billion.

During the course of these proceedings extensive gas surveys have been carried on at a cost of several million dollars to the applicant companies. As a result, a vast fund of technical information has been accumulated by geologists, engineers, marketing and finance experts, all of which is of benefit to the government and the public at no cost to them.

The government board has consistently maintained that it would not approve the export of gas until known reserves were sufficient to meet Alberta's own needs and the probable increase in these requirements for the next thirty years. Considered opinion from authoritive sources is that the point has been reached, and there is expectation that exportation on some scale may soon be authorized.

Six separate companies have asked for permits to export Alberta gas, backing their requests with detailed plans, specifications and financial proposals. These are: Northwest Natural Gas Co., route from Pincher Creek to British Columbia and U. S. Pacific Northwest; Trans-Canada Pipe Lines Ltd., subsidiary of Canadian Delhi Oil Ltd., route from southern Alberta to Ontario and Quebec; Westcoast Transmission Co. Ltd., route from Dawson Creek, B. C., south to Prince George and Kamloops, west to Vancouver and then south over the border to U. S. points; Prairie Pipe Lines Ltd., subsidiary of Pacific Northwest Pipeline Corp., with a proposal for reciprocal exchange of gas from Pincher Creek to the U. S. Pacific Northwest and Vancouver, in return for gas from Texas for distribution in Ontario; Western Pipe Lines, route from southern Alberta through Saskatchewan and Manitoba to the U. S. border, 75 percent of the capacity of the pipe line being on contract for distribution in the United States; and McColl-Frontenac Co., route from southern Alberta to points in Montana, an amount in addition to export already approved over this route to the Anaconda Copper Mining Co. in Montana for strategic purposes.

Gas has been found in varying quantities at many places in Alberta from Pincher Creek in the south to the Peace River district in the north. The Pincher Creek field is rated as among the largest at the present time, and an outline of the economic advantages to Alberta Province from its projected development is illuminating as an example of the potentialities in this great hydrocarbon resource.

Pincher Creek field, operated by Canadian Gulf Oil, is a major producer of wet gas with a high content of sulfur which would need to be removed from the gas before pipe line transmission. To bring the field up to the stage of operation contemplated requires a large and stable market which only export can provide. To accomplish this, an expenditure of $20 million on the drilling and equipment of additional wells is projected. For recovery of the sulfur and various by-products, an industrial plant costing another $20 million is to be constructed. It is estimated that by its fourth year of operation, this plant could produce 200,000 tons of sulfur per year, which is about two-thirds of Canada's present requirements.

The value of Pincher Creek field operations in their fourth year are calculated as follows:

| | |
|---|---|
| Natural Gas, 54,750 mcf @ 11c | $6,022,000 |
| Distillate oil, 2 million bbl. @ $3.28 | 6,560,000 |
| Butane, 300,000 bbl. @ $1.57 | 472,500 |
| Propane, 372,000 bbl. @ $1.68 | 624,960 |
| Nat. Gasoline, 286,000 bbl. @ $2.52 | 720,720 |
| Sulfur, 216,000 tons @ $22.00 | 4,752,000 |
| Total | $19,152,180 |

Of the total value of these operations, only 31.4 percent would represent gas export. Canadian Gulf Oil Co. has entered into a contract with Northwest Natural Gas Co. to deliver gas for export over a period of 25 years. The availability of gas and its by-products is expected to attract petro-chemical industries to the area.

While the bulk of the supply of Northwest Natural Gas Company will come from the Pincher Creek field, this may be supplemented through gathering lines from other southern Alberta fields as the government authorities may direct. The route to be followed by the company's main line will be from Pincher Creek through the mountains at Crowsnest, across the border into the United States, then west to a point north of Seattle and from there north to Vancouver and British Columbia and south to Seattle, Portland and other United States cities. This route of the main transmission line offers no construction difficulties, and will deliver gas at low cost to consumers in Canada and the United States, while the absence of maintenance problems will afford continuity of supply.

Contracts have been secured with the Seattle and Portland gas companies, and with others at points of destination, covering sales of Alberta gas to these various centers, once the necessary export permit is granted. The route provides also for supplying the large defense plant at Trail, British Columbia, as well as the United States atomic plant at Hanford in Washington. The Canadian market is protected, in so far as supply of gas is concerned, by priority clauses.

With Alberta's known gas reserves now standing at 8,000 billion cubic feet while slightly over 3,000 billion feet are Alberta's estimated requirements for a thirty year period, there is a very large surplus available for export to areas persistently asking for it, and the sale of gas and its products will add greatly to Canada's trade balance. Moreover, with permission to export being given, the gas reserve will immediately start to rise rapidly since exploration and drilling for gas will be encouraged by the existence of markets ready to absorb great quantities.

# Export-Import Reflects Iranian Deficit

WASHINGTON

IMPACT of the shutdown of oil operations in Iran last summer is reflected in figures, now available, on imports and exports of crude oil and products going to and leaving the United States during the year 1951.

The year's totals show that imports of both crude and products were relatively close to the total quantities that came in during the preceding year. Crude imports were slightly higher while receipts of products were somewhat lower. Among the products exported, residual fuel oil showed a very substantial gain during the second half of the year. Residual exports for the four months ending October were more than double those for the first four months of the year. Total crude and product imports amounted to about 850,000 barrels a day as an average, compared with 847,000 for the year before.

While there was a 16 percent drop in exports of crude, shipments of products rose 70 percent last year as compared with the year before. A total of 130 million barrels of products were exported, compared with 76 million barrels the year before. Crude oil exports in 1951 amounted to 28 million barrels.

A glance at the month-by-month figures for the year shows that in the early part of the year, product exports totaled slightly above five million barrels. In the months July, August, September, they went to two to three times this level.

The outlook for the rest of this year is clouded, but if the Iranian oil shutdown continues throughout the year, the general thought of oil men and the government is that the world oil industry will have a full job meeting demand. Capacity operations, a tight supply situation, but no serious shortages, are foreseen.

Hazarding a glance into the future, Cecil L. Burrill, director of the program division of the Petroleum Administration for Defense, gave his views in an address on January 14.

"Let us fervently hope," he said, "that the industry is not called upon to supply products for a new emergency during this year. In 1950 we experienced the additional demands consequent to the Korean War, and in 1951 it was the Iranian shutdown. It is doubtful that the petroleum industry could make available sufficient products if additional demands such as those caused by the mobilization program or the Iranian crisis were superimposed on the present demand structure."

Forecasting a need for capacity operations, Mr. Burrill said the petroleum agency estimates that a crude oil output in the United States of 6,358,000 barrels daily will be required as an average, an all time high. Refinery throughput, he believes, should be at its peak, 6,770,000 barrels daily as a year average. He added:

**Exports of Principal Products—1951**
**(000's of barrels)**

| | Aviation Fuel | Motor Fuel | Distillate | Residual |
|---|---|---|---|---|
| January | 415 | 1,788 | 916 | 946 |
| February | 431 | 1,607 | 844 | 1,036 |
| March | 884 | 2,349 | 980 | 1,474 |
| April | 663 | 2,444 | 1,549 | 1,446 |
| May | 915 | 2,830 | 2,192 | 2,927 |
| June | 858 | 3,159 | 1,421 | 2,902 |
| July | 1,228 | 4,191 | 2,457 | 3,671 |
| August | 1,327 | 4,807 | 3,460 | 3,446 |
| September | 1,272 | 4,782 | 2,818 | 3,454 |
| October | 1,150 | 3,984 | 2,570 | 3,045 |
| November | | | | |
| December | | | | |

**Exports of Principal Products—1950**
**(000's of barrels)**

| | Aviation Fuel | Motor Fuel | Distillate | Residual |
|---|---|---|---|---|
| January | 472 | 1,597 | 876 | 1,178 |
| February | 465 | 1,895 | 1,193 | 977 |
| March | 271 | 1,691 | 1,152 | 1,604 |
| April | 385 | 2,357 | 1,033 | 1,201 |
| May | 963 | 2,227 | 874 | 1,270 |
| June | 527 | 1,914 | 895 | 1,844 |
| July | 592 | 1,992 | 1,116 | 1,299 |
| August | 525 | 1,585 | 967 | 1,639 |
| September | 597 | 2,380 | 1,061 | 1,189 |
| October | 550 | 2,340 | 1,339 | 898 |
| November | 710 | 2,047 | 1,112 | 1,402 |
| December | 975 | 2,491 | 943 | 1,726 |
| Year | 7,032 | 24,516 | 12,561 | 16,227 |

**U. S. IMPORTS—Thousands of Barrels**

| | Crude Petroleum | | Refined Products | |
|---|---|---|---|---|
| | 1951 | 1950 | 1951 | 1950 |
| January | 15,472 | 15,102 | 14,958 | 10,959 |
| February | 13,096 | 11,499 | 13,143 | 7,663 |
| March | 14,971 | 14,614 | 11,688 | 12,332 |
| April | 15,319 | 15,336 | 10,978 | 11,315 |
| May | 16,051 | 13,618 | 11,097 | 10,135 |
| June | 16,889 | 14,931 | 9,385 | 10,203 |
| July | 16,940 | 15,076 | 7,500 | 9,900 |
| August | 16,404 | 15,539 | 7,783 | 10,476 |
| September | 15,000 | 15,760 | 7,318 | 10,005 |
| October | 13,054 | 15,809 | 10,778 | 11,965 |
| November | 14,400* | 13,992 | 11,200* | 12,736 |
| December | 14,880* | 16,438 | 12,160* | 13,746 |
| Year | 182,476* | 177,714 | 127,988* | 131,435 |

*Estimated

**U. S. EXPORTS—Thousands of Barrels**

| | Crude Petroleum | | Refined Products | |
|---|---|---|---|---|
| | 1951 | 1950 | 1951 | 1950 |
| January | 2,913 | 2,130 | 5,413 | 5,168 |
| February | 2,471 | 2,196 | 5,290 | 5,815 |
| March | 2,640 | 2,153 | 7,299 | 6,269 |
| April | 3,615 | 2,968 | 7,940 | 6,467 |
| May | 1,791 | 2,946 | 11,143 | 6,327 |
| June | 2,342 | 3,226 | 10,319 | 6,109 |
| July | 2,320 | 3,250 | 13,506 | 6,303 |
| August | 2,361 | 3,096 | 15,397 | 5,953 |
| September | 2,199 | 2,654 | 14,919 | 6,940 |
| October | 1,947 | 4,033 | 12,413 | 6,586 |
| November | N. A. | 3,229 | N. A. | 6,727 |
| December | N. A. | 2,917 | N. A. | 7,464 |
| Year | 28,500* | 34,798 | 128,000* | 76,237 |

*Estimated

"The net effect of all measures taken abroad to meet shortages caused by the Iranian shutdown is that foreign refineries are operating substantially at capacity, and it is still necessary to obtain from the United States products in the amount of about 110,000 barrels daily during the first quarter of 1952.

"Our estimate of imports of crude and products for the year 1952, therefore, indicates a total of 894,000 barrels daily compared with an average of 850,000 barrels daily in 1951. The somewhat higher rate forecast in the current year is no more than is required to bring imports during the last half of the year to a level consistent with demand.

"Imports during the second half of 1951 were abnormally low, probably because of the effect of the Iranian shutdown, which forced some diversions to foreign areas.

"My conclusion on imports, therefore, is that there is a current need for additional imports, particularly of heavy fuel oil, which unfortunately does not appear to be available.

"As to exports from the United States, our estimate of 240,000 barrels daily during the last half of 1952 reflects the elimination of extraordinary exports caused by the Iranian crisis and a return to the steady decline which has taken place since the end of World War II.

"This decline is the result of the development of new crude oil supplies in Canada and of the expansion of refinery capacity abroad, particularly in Europe, but also in South America.

"It is to be expected that United States exports will continue to decline, but obviously any further decline from the expected level of 240,000 barrels daily in the last half of 1952 will not be very significant in relation to current domestic demand of 7,980,000 barrels daily.

"Let me say two things. First, while the supply situation will be tight during the next few months, and although we may experience spot shortages here and there, the situation is not unmanageable, and we should be able to meet the expected demands.

"Secondly, and of extreme importance from a security point of view, we have consumed practically all of our reserve capacity and are in a much worse position today to fight a major war than we were in 1940 when we had 25 percent spare refining and crude oil capacity. We desperately need to build spare capacity in producing, refining and attendant facilities. At present we have no flexibility with which to meet even possible peacetime emergencies let alone those demands that would result from a full scale war."

Exports of principal products for the year 1950 and the first ten months of 1951 for which statistics are available are shown in the accompanying tables, the figures being in thousands of barrels.

# British Oil News

By E. Lawson Lomax

## Iranian Stalemate

At the turn of the year little indication of change was observable in the disputed Iranian oil situation. Reports from Teheran were that internal conditions were steadily worsening with labor troubles rife in Abadan on account of non-payment of wages and salaries and continued looting of field and refinery installations spreading to such an extent that many plants have been stripped of essential parts and could only be restored to operation by complete replacements.

Opposition to the Mossadegh government is said to be more open, with demands being made for impeachment of the premier and acts of terrorism, both by nationalists and their opponents, more frequent. Dr. Mossadegh himself has given no public evidence of any change in attitude and a published announcement states that he has rejected a proposal put forward by the International Bank for Settlements, with which of course neither the British government nor Anglo-Iranian Oil Co. had any connection, for setting up a sort of international trusteeship for handling Iranian oil.

An apparent inconsistency in the Mossadegh policy is that while he has steadily maintained that the International Court of Justice at The Hague had no jurisdiction in the dispute, application has been made for postponement of the case for one month from the original date of January 10 in order to permit the Premier to appear personally to contest the court's claim.

## Production

Apex (Trinidad) Oilfields Ltd. reports production of crude oil and casing-head gasoline for the month of November 1951 to be 268,285 barrels.

Anglo-Ecuadorian Oilfields Ltd. reports production of crude oil for the month of November 1951 to be 22,261 tons.

## Iraq Takes Over Local Refineries

By an agreement between Anglo-Iranian and the government of Iraq, the latter will take over two small subsidiaries of the former, Khanaquin Oil Co. and Rafidian Oil Co., which have been engaged in supplying petroleum products for local use. Thus the government will control all distribution of oil supplies inside Iraq and will get a half share of profits. The two firms will transfer the Khanaquin refinery, all their oil depots, reservoirs, distribution centers and all land and river transport to the government. The Khanaquin Oil Co. will act as distribution agents in Iraq until 1961, and will erect a refinery in Basrah to process products for markets in southern Iraq.

## Personalities

C. C. Wakefield and Co., Ltd. announces the appointment of Alonzo Limb as sole managing director. Previously, he has shared the responsibilities of this post with Walter H. Senneck who has now retired after 45 years service. Mr. Senneck will retain a seat on the board. Mr. Limb joined Wakefields in 1916 and in 1926 took charge of motor and aviation sales. In 1938 he joined the board of the company.

Appointment of William F. List and Leonard M. Broadway as assistant managing directors is also announced. Mr. List has spent the majority of his 41 years with the company in its overseas service. He became a director in 1947. Mr. Broadway joined Wakefields in 1920, was appointed secretary of the company in 1938, and a director in 1947.

Christopher T. Brunner, M.A., M.Inst. T., director and general manager of Shell-Mex and B. P. Ltd., was educated at Nottingham High School and Manchester University. He joined Shell-Mex in 1926. During the war he was secretary of the management committee of the Petroleum Board. He was appointed an assistant general manager of Shell-Mex and B. P. Ltd., and in 1950 was elected a director and appointed a general manager.

Kenneth Gordon has been appointed to the board of Head Wrightson Processes Ltd., London, as deputy managing director. In his career Mr. Gordon has been connected with many important developments in the heavy chemical and petroleum industries and has had extensive experience in company management.

John Livingston Flanagan, manager of Shell's fuel oil department, retired December 31 on reaching the age limit and was succeeded by his deputy, Dennis Beaumont Vale.

Edward W. Taylor of the head office staff of G. A. Harvey & Co. (London) Ltd. retired on December 17 after 57 years service, spent partly in the accounts department and partly in the sales department. This is a record for individual service with the company.

## Drilling In Kuwait

Drilling, which started in October last, in a new area of Kuwait about seven miles north of the Burgan field, has brought in good production. It is, however, not yet certain whether the new well is an extension of the existing field or is an entirely new pool. The oil from it is similar to if not identical with that produced in the Burgan field. The oil concession negotiations which have been proceeding between his Highness the Shaikh of Kuwait and the companies owning the Kuwait oil concession have been concluded and agreement has been reached. Henceforth, the revenue of Kuwait from its crude oil production will be substantially increased; negotiations have also led to agreement being reached on all outstanding questions.

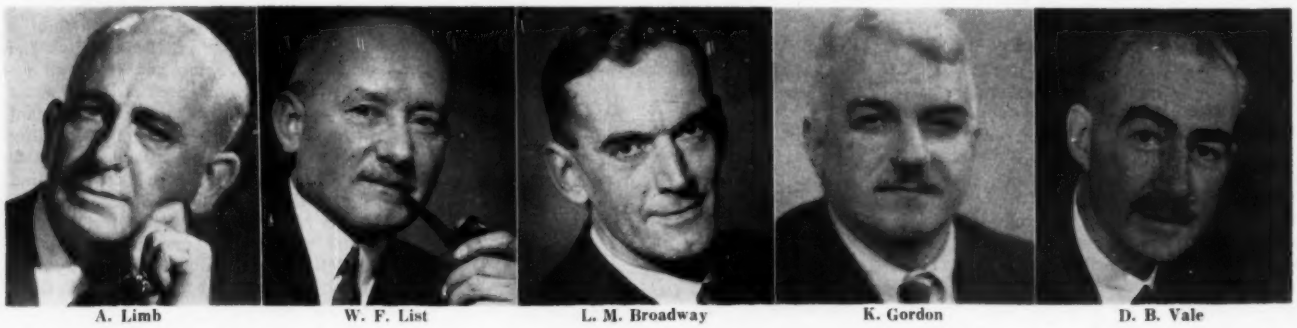
The companies will submit to an income tax to be imposed December 1, 1951, which will bring about the equal sharing of profits by Kuwait and the company. In this way Kuwait's revenue will be comparable to the revenue from this source existing in the neighboring Arab states. Provision has also been made for a contribution by the company to the cost of higher education of Kuwaiti students at universities and schools outside Kuwait.

## Catalyst Manufacture In U.K.

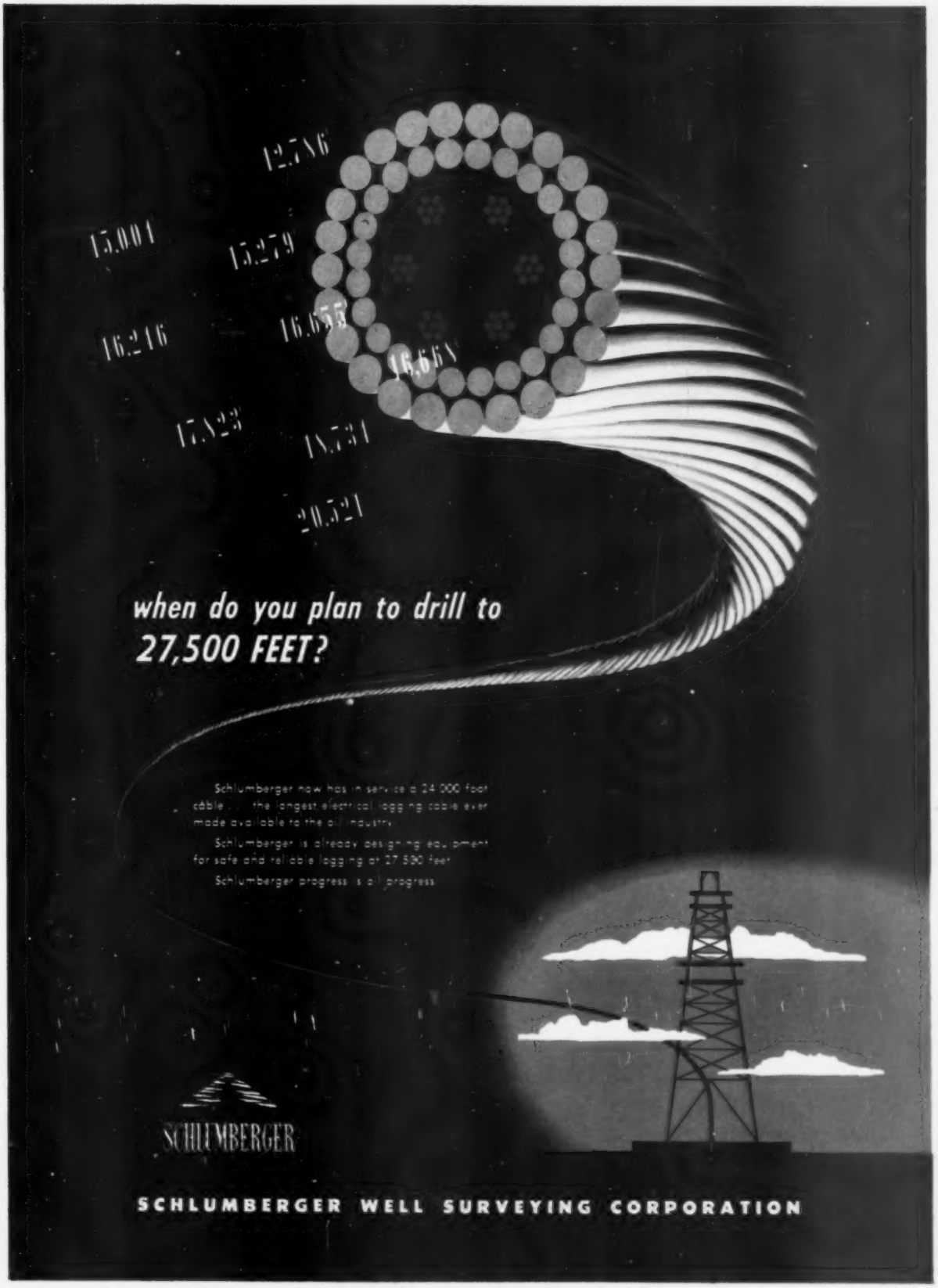
As a result of agreements between Joseph Crossfield and Sons, Ltd., an associated company of Lever Bros. and Unilever Ltd., and the Davison Chemical Corp. of Baltimore; and between Crossfield's and the Esso Petroleum Co., Anglo-Iranian Oil Co., Shell Refining and Marketing Co., Trinidad Leaseholds and Bahrein Petroleum Co., a £1,000,000 plant for the manufacture of catalyst required in fluid catalytic cracking plants has been built and is in operation at Warrington. It will manufacture and supply the catalysts required by the five petroleum companies in the sterling area. The raw material for the process is sodium silicate, of which Crossfields are the major manufacturers in the U. K. Crossfields have been to the fore in the manufacture of commercial catalysts since the early days of their development for use in the hardening or hydrogenation of fats for soap manufacture.

Plant equipment includes two Swenson Evaporator Co. stainless steel dryers which have been fabricated under license in the U. K. They are the largest dryers of this type which have been made. Because of the strict chemical and physical conditions which must be observed at all stages in manufacture, the plant embodies some of the most modern methods of control in the form of automatic temperature, pressures and flow controllers.

The main contractors for the plant were E. B. Badger and Sons (Gt. Britain) Ltd., Taylor Woodrow Construction Ltd. and Swenson Evaporator Co.



A. Limb | W. F. List | L. M. Broadway | K. Gordon | D. B. Vale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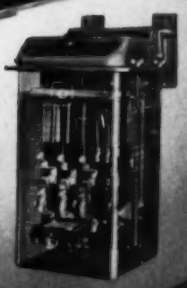

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## Company Reports

Apex (Trinidad) Oilfields Ltd. reports a successful year of operation, dividend being raised from 1/9d free of tax to 2/- free of tax. Profit for the year to September 30, 1951 was £530,733 after providing £1,070,000 for taxation, £200,000 for development and contingencies and £100,000 for staff pensions. £300,000 is transferred to general reserve, and unappropriated profit carried forward will amount to £234,138.

The directors of Kern Oil Co. Ltd. have recommended a dividend for the year ending May 31, 1951 of 12½ percent and a bonus of 5 percent, total 8.4d per stock unit of 4s; less income tax of 9c6d; absorbing a net amount of £110,595. Net profit for the year, including £29,940 interest on U.S.A. tax refunds, was £242,472 after debiting £161,432 for depreciation and £421,770 for taxation; the charge for taxation is after debiting a net amount of £16,066 in respect of adjustments for past years. A dividend of 10 percent has been received from Kern Trinidad Oilfields Ltd. and is included in the above figures. There has been transferred to general reserve £111,458. The carry forward is £202,989.

The annual report of London and Coastal Oil Wharves Ltd. shows a successful year of operation, with increased turnover, the signing of a long-term storage agreement with Regent Oil Co. and a moderate extension of storage capacity. Negotiations are nearing completion for leasing part of the company's land to the Regent Oil Co. which proposes to erect thereon storage tanks with adjacent jetties.

## Search for Oil In Britain

Drilling has been stopped at 4,353 feet in the test well being drilled just above high water mark on the dunes near Ainsdale-on-Sea, Southport, Lancashire, by the D'Arcy Exploration Co. (The Anglo-Iranian's prospecting subsidiary).

Although oil has not been found, the operation has provided useful geological information which encourages further drilling. A considerable amount of geophysical exploration has been done in the Formby area and every borehole drilled helps the geologist in interpreting results.

The Ainsdale well was drilled as part of a plan to locate the reservoir from which has seeped the oil being produced from shallow wells three miles away at Formby. About 8,400 tons of oil have been produced from this shallow field. Data appear to confirm that the original geophysical interpretation was substantially correct, and the oil indications found in the hole suggest that the program of oil search is proceeding on the right lines. A location for the next well has been selected and it probably will be drilled shortly.

## Diesel-Electric Locomotives Abroad

Dieselization of railroads in many countries is proceeding at a rapid pace. Some idea of the extent of the transition is seen in the annual report of activities of the English Electric Co. Ltd., Stafford.

During the past year English Electric has delivered 58 diesel-electric switch engines to railroads in the United Kingdom, the Netherlands, Australia and New Zealand. It has delivered 28 main line diesel electric locomotives in Australia and Egypt. At the beginning of the year the company had on order for future delivery 39 switch engines and 54 main line diesel-electric locomotives.

## To Drill Deep Test In Assam

A 15,000-foot test of oil possibilities in the Brahmaputra Valley, Assam, India, has been spudded by the Assam Oil Company, Ltd. at a site 13 miles south of Tinsukia, in the northeast corner of the State. Geophysical surveys have been conducted throughout 8,000 square miles of the Brahmaputra Valley and the adjoining hills.

The company has another test well drilling below 4,000 feet at Nichuguard, about 10 miles from Dimapur, in the Naga Hills of Assam. Dry holes recently were drilled by the company at Tiru Hills and Barsilla.

## Fighting An Oil Well Fire

"Rig 20," a film produced by the Anglo-Iranian Oil Co., shows the struggle to put out the huge blaze at Naft Safid, in southern Iran, when a well in that field caught fire last spring. The operation was carried out under the personal direction of Myron Kinley, the American expert on oilfield fires. The film emphasizes the gigantic subterranean forces which can be released accidentally during drilling operations, and the great and dangerous effort needed to resume control over them.

A particularly impressive shot is that of a half mile of 4½ inch pipe being flung a thousand feet into the air and twisting about like a length of string after a charge had been exploded to clear wreckage from the well-head prior to the actual extinguishment.

## Reconstruction At Avonmouth

The replanning and rebuilding of the storage tank and loading facilities destroyed by fire at the Regent Oil Co.'s Avonmouth installation last September is proceeding rapidly. To date the damaged fire walls have been demolished and the tankage affected by the fire has been cut down and all steel that is possible to reclaim for use again has been salvaged.

Opportunity has been taken of producing a layout which will incorporate the latest practice in the construction of oil storage, each large storage tank being contained in its own fire bund and the maximum amount of protection being given to pipelines. Special arrangements have been made to bring the pump houses and loading bridge into operation again so that loading from the tanks not affected by the fire can take place.


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# International news and notes

## Pemex Plans Active Year

Mexico's domestic and foreign oil sales will climb to $231 million dollars this year, it is predicted by Senator Antonio J. Bermudez, director of Petroleos Mexicanos. Last year, the government oil agency's sales totaled $207 million.

An all-out effort will be made to drill 400 new wells this year. In 1951, Pemex put down 267 despite shortage of equipment. Other parts of the program for 1952 include construction of four pipe lines totaling 322 miles to distribute products from the Salamanca refinery; construction of 319 miles of 16 and 20-inch gas pipe line; construction of a 118-mile 10-inch oil pipe line from the El Plan field to the new Jose Colomo field; completion of the rebuilding of the Ciudad Madero and Minatitlan refineries; erection of gasoline treating plants at the Atzcapotzalco and Ciudad Madero refineries; construction of the $20 million lubricants plant at the Salamanca refinery; and construction of a $6 million shipyard at Veracruz for the construction of tankers and major marine repairs.

Senator Bermudez reported that in 1951 Pemex discovered five new oil fields and one gas field. Estimated reserves at the year end were 1,796 million barrels. Gas production last year was largely increased to 250 million cubic feet daily. Oil deliveries were improved by completion of the trans-isthmus products line, larger use of tank trucks, and enlarging of the tanker fleet by acquiring six large tankers and 18 smaller vessels.

## New Discovery In Kuwait

Kuwait Oil Co. has substantial showings of oil in its Magwa No. 1 seven miles north of the Burgan field in Kuwait. Showings were found in the Burgan series of middle Cretaceous sands from which the adjacent prolific field is producing.

The well is being drilled deeper for a thorough testing of the series and is not being produced. In Burgan the Cretaceous has a thickness in some parts of the field of some 1,000 to 1,300 feet.

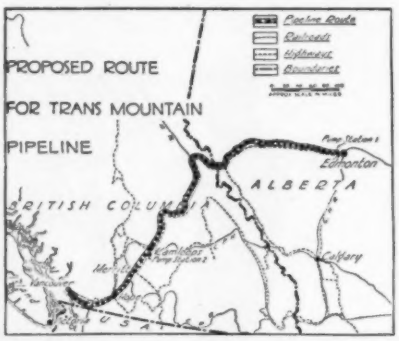
Company geologists have not expressed an opinion as to whether the Magwa well is an extension of the Burgan field or whether it indicates the presence of a new structure. There are no dry holes which have been drilled between. Geophysical surveys on which the well was drilled suggest that the discovery may have penetrated a new field of somewhat smaller area than the 80,000 acres in Burgan proper, which previously was considered as having been well outlined on a 600-acre pattern. Recent drilling has been of fill-in wells.

The Burgan field has been estimated to contain reserves totaling as much as fifteen billion barrels. The new well probably will necessitate a reappraisal of producible volumes of oil. In 1951 Burgan produced about 208 million barrels of oil, about five percent of the world's supply.

## Crude Oil Lines To Pacific

Following approval by the Canadian Board of Transport Commissioners of the proposal of Transmountain Pipeline Co. for the construction of a crude oil line from Edmonton, Alberta, to Vancouver on the Pacific Coast which was granted in December last, it was announced by Van Rosendahl, president of Canadian Bechtel Ltd., organizers of the project, that construction would begin as soon as weather permitted.

The line will be 693 miles in length with pipe of 24-inch diameter and will have an initial daily capacity of 75,000 barrels which can be increased later to 200,000 barrels by installation of additional pump stations. Cost of the undertaking is estimated at $82,000,000.




Pipe laying contracts have been awarded to Fred Mannix & Co. Ltd. of Calgary, Canada, for the central portion of the line, 221 miles in length, and to Comstock Midwestern Ltd., affiliated with Midwestern Constructors Inc. of Tulsa, Okla., for the eastern and western portions with a mileage of 472. Preliminary work of hauling and stringing pipe on these sections will be handled by Canadian Parkhill Pipe Stringers Ltd., the Canadian company of Parkhill Truck Co. of Tulsa. Engineering and supervision of the line will be in the hands of the Bechtel organization which has built most of the world's most important lines in different countries.

## To Produce Catalyst In Europe

A Netherlands chemical firm will become continental Europe's first producer of synthetic fluid cracking catalyst for the petroleum industry under terms of a contract signed recently with American Cyanamid Co. Koninklijke Zwavelzuurfabrieken ("Ketjen") of Amsterdam will manufacture Cyanamid's microspheroidal cracking catalysts, using Cyanamid's patents and processes, for sale to Western European oil refiners. Production will begin early in 1953 and will be sufficient to handle an annual refining capacity of more than 56 million barrels of crude oil.

## Venezuela Production

Crude production in Venezuela increased 13.8 percent in 1951 to 1,704,643 barrels daily. In December, output was at a new high averaging 1,776,386 barrels daily. Production by companies in the fourth quarter is as follows:

| | Daily Average Barrels | | | |
|---|---|---|---|---|
| Company | Oct. | Nov. | Dec. | Year |
| Creole | 778,088 | 781,827 | 804,866 | 773,663 |
| Shell | 536,767 | 556,436 | 567,933 | 527,321 |
| M.G.O. | 253,893 | 260,398 | 244,076 | 245,273 |
| Socony | 54,494 | 52,566 | 54,247 | 49,319 |
| Texas | 23,322 | 18,972 | 24,251 | 23,625 |
| Mercedes | 24,159 | 23,939 | 23,857 | 23,177 |
| Atlantic | 18,341 | 17,645 | 18,032 | 18,932 |
| Richmond | 14,170 | 9,306 | 8,865 | 13,489 |
| Sinclair | 13,125 | 13,768 | 13,272 | 12,481 |
| Pantepec | 9,137 | 11,134 | 8,672 | 10,042 |
| Phillips | 6,392 | 7,263 | 7,361 | 6,371 |
| British | 920 | 910 | 954 | 949 |
| Guasare | .... | .... | .... | 1 |
| Otras | .... | .... | .... | .... |
| Total | 1,732,808 | 1,754,164 | 1,776,386 | 1,704,643 |

Petroleum refined in Venezuela during October amounted to 9,993,052 barrels, or 322,357 b/d. This represented an increase of 15,000 b/d over September's throughput, and an increase of 28,000 b/d over that of October 1950. Total refinery runs for the first 10 months of 1951 amounted to 94,013,530 barrels.

## Aramco Organization Changes

Appointments to six newly created positions as general managers in the Arabian American Oil Co. organization in Saudi Arabia were announced early in January by W. F. Moore, president.

T. C. Barger was named general manager for concession affairs. Mr. Barger, after a geological background, joined Aramco in 1937 and has specialized in government relations work since 1941.

W. R. Cooper was appointed general manager of the construction, maintenance and transportation department. Mr. Cooper joined the Texas Co. in 1928 and transferred to Aramco in 1944 as superintendent of engineering.

E. C. Austin was appointed general manager of materials, supply and community service. Mr. Austin joined Aramco in 1939 and has served in various capacities since that time.

T. V. Stapleton was appointed general manager of field management. Mr. Stapleton joined The Texas Co. in 1923 and worked continuously for them until 1944 when he transferred to Aramco as refinery manager.

R. A. Eeds was named general manager of the field operations department. Mr. Eeds has been with various subsidiaries of Standard Oil Co. since 1933 and joined Aramco in 1950 as assistant general manager in charge of oil operations.

W. A. Weber was appointed general manager of industrial relations. Prior to joining Aramco, Mr. Weber spent 19 years in personnel work with Standard Oil Co. of California.

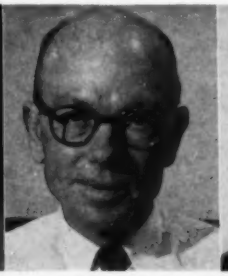
Mr. Moore also announced the appointment of D. N. Ezell as manager of the manufacturing and supply department and S. C. Harper as assistant to the general manager of oil operations. Mr. Ezell came to Aramco in 1950 after having been with the Magnolia Petroleum Co. since 1938. Mr. Harper has been with Aramco since 1944 after having served since 1927 with the Texas Co.

T. C. Barger

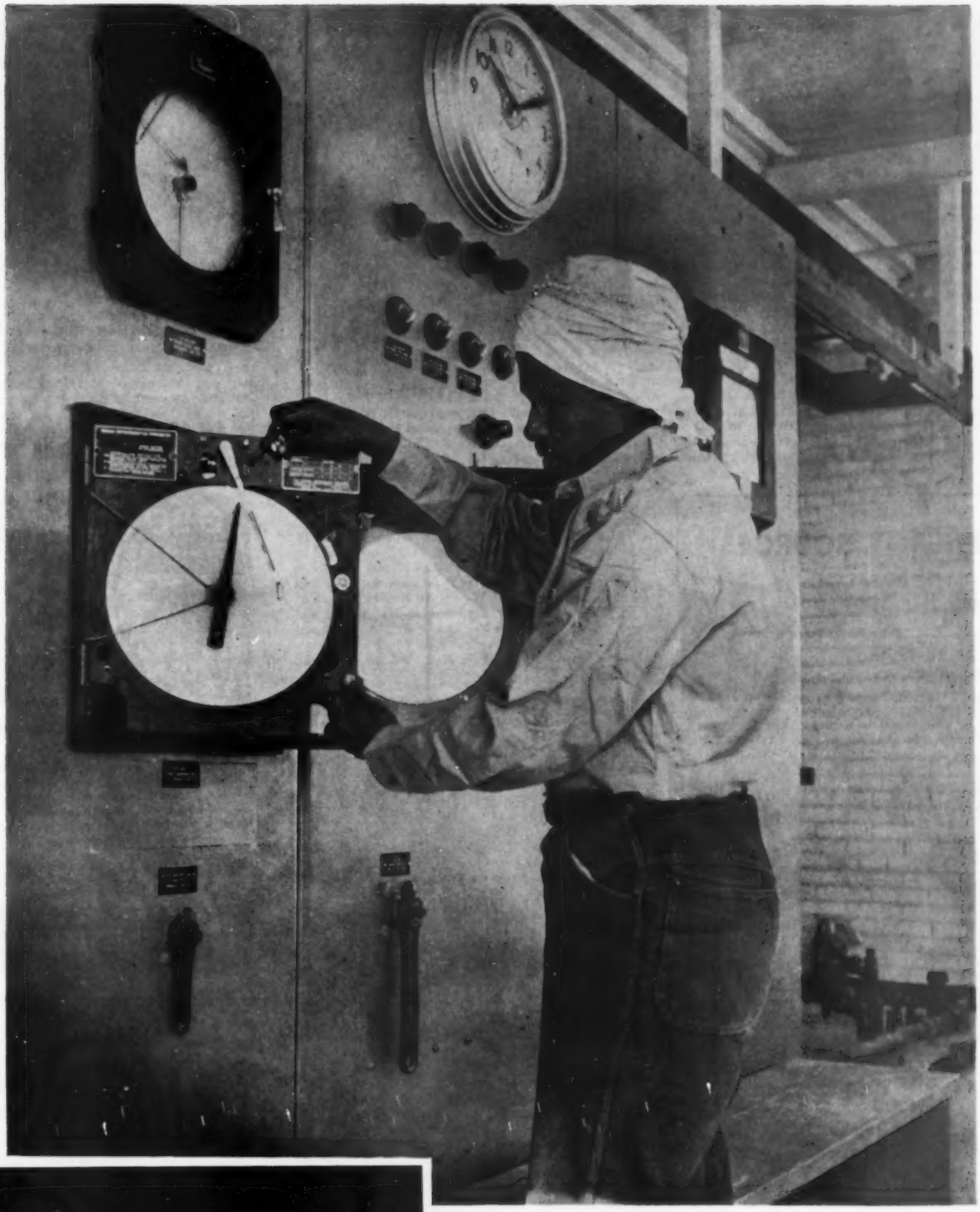
W. R. Cooper

E. C. Austin

T. V. Stapleton


R. A. Eeds

W. A. Weber



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## Poza Rica Investment Increased

Petroleos Mexicanos invested 225,000,000 pesos during 1951 in the improvement of its facilities at Poza Rica, Mexico's richest oil field. This compares with a total investment of 298,600,000 pesos during the entire six-year period from the beginning of 1946 to the end of 1951.

Among the installations of the last twelve months are a salt-feeding and crude-stabilizing plant for the separation of oil, salt and dissolved gases; an absorption plant for recovering light hydrocarbons; and a gas-purification unit for eliminating hydrosulfuric acid and carbonic gas. At the same time, plants were installed for the recovery of sulfur, for the elimination of water from gas destined for Mexico City, and for the chemical treatment of water, along with machinery for reinjecting gas into wells to increase pressure and electric-power and cooling units.

## Drilling In Colombia

At the opening of 1952 there were 15 drilling rigs operating in Colombia. Shell was operating five; Texas, four; Barco, three; Intercol, two; and Richmond, one. In the first 11 months of 1951, 110 wells were completed, of which seven were dry and 103 successful. Six of the wells completed were wildcats, of which three were successful and three dry.


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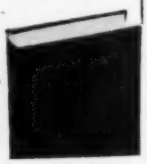

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B. W. Gillespie

## B-A Oil Appointments

Bart W. Gillespie has been appointed manager of the exploration and production departments of the British American Oil Co., Ltd. in Canada with headquarters in Calgary. He succeeds James J. Statler, who resigned. Before coming to British American, Mr. Gillespie was the general manager of the Mexican American Independent Co. in Mexico City.

Mr. Gillespie served in both World Wars. In civilian life he has engaged in oil activities in Mexico, Peru, Alaska, and California. He was field manager for Cia. de Petroleo Ganza Azul in Peru. During World War II he was in charge of all naval exploration activities in the Arctic, and remained in Alaska after the war as project manager for Arctic Contractors Ltd. which was carrying on exploration and drilling activities for the navy.

J. W. Morgan

British American has also appointed J. W. Morgan as manager of its Montreal East refinery, succeeding the late R. F. A. Smith.

A graduate of the University of Alberta in chemical engineering, Mr. Morgan joined British American at Calgary refinery in 1939. After holding several positions in the manufacturing department, he became administrative assistant to the manager of manufacturing in 1949. He was appointed assistant manager of the company's Moose Jaw plant last year.

Mr. Morgan has been on loan to the Department of Defense Production, Petroleum Division, for the past six months, during which time he was on specific assignments in Washington, D. C.


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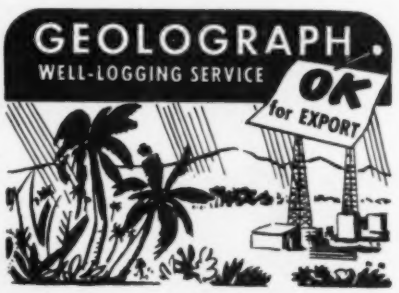
## Williston Basin Discovery In Canada

Visions of a possible great expansion of oil production in Saskatchewan, Canada, were spread among residents of that province by the bringing in on Jan. 6 of a well providing good showings of 26 to 30 gravity oil near the town of Roseray in the southwestern part of the province and about 100 miles from the nearest Canadian oil field. The well was drilled by the Western Prairie Exploration Co., an affiliate of Socony-Vacuum Oil Co., and is designated as Roseray No. 1. Oil was found in the Blairmore formation of the Lower Cretaceous on test from 3,070 to 3,100 feet. The well is situated in the Canadian section of the Williston Basin which extends into the northern United States where impressive discoveries have been made during the past year in North Dakota and Montana.

## East Pakistan Test Planned

Pakistan Petroleum Limited soon will start a deep test in Patiya, Chittagong district. The well may be carried to 14,000 feet if necessary. Preliminary work of constructing an approach to the densely wooded location on the far side of the Karnafuli river, establishing a camp and bringing in of more than 6,000 tons of material is being carried out.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## Book Review

Petroleum Conservation, edited by Stuart E. Buckley; published 1951 by American Institute of Mining and Metallurgical Engineers, Philadelphia; 304 pages; $6, members $3.

This work was sponsored by the Henry J. Doherty Memorial Fund as a tribute to the man who first pointed out that prevention of waste in the petroleum industry could only be accomplished by unit operation of oil and gas fields. The editor and his collaborators, who are all petroleum engineers, have labored with success to show the engineering concepts that govern the operations of producing oil and gas with an eye to maximum recovery of this irreplaceable natural resource from its reservoirs. They make out an excellent case for unit operation, and they explain how unit projects are now being organized and managed. Legislators who have to frame petroleum laws, and particularly royalty owners whose cooperation is essential if the old law of capture and its anarchy and waste is to be done away with, should buy and study this book.

## Plan Three TCR Units

Socony-Vacuum Oil Co. has asked the government clearance for the erection of three catalytic reforming units and a catalyst manufacturing plant to cost $27 million. The process would be installed at Augusta, Kan., Beaumont, Texas, and Torrance, Calif., the catalyst plant at Paulsboro, N. J. Combined capacity of the three units would be 37,000 b/d.

The Socony-Vacuum version of the modern catalytic reforming process employs a catalyst developed in cooperation with the Standard Oil Co. of Ohio. The catalyst is circulated as a moving bed following the type of flow developed for the Thermofor catalytic cracking process. Since the volume of catalyst circulated in the reforming process is much less than that required for cracking, it is planned to use mechanical conveyors rather than an air lift.

**Howard B. Book hands the New York Nomads gavel to incoming president A. A. Dill.**

## Dill Heads New York Nomads

A. A. Dill, Axelson Manufacturing Co., will head activities of the New York Chapter of Nomads as president during 1952. Other new officers are: vice president, Russ V. McIntire, Baker Oil Tools, Inc.; secretary, Jesse E. Hickman, Beckley, Haltom and Hickman; assistant secretary, O. B. Latrobe, Hughes Tool Co.; treasurer, E. R. Smoley, The Lummus Co.; assistant treasurer, Don E. Kircher, Gardner-Denver Co.; sergeant-at-arms, C. P. MacDonald, Parkersburg Rig and Reel Co.; assistant sergeant-at-arms, Edmund Burke, Jr., General Motors Overseas Operations; regent, Henry J. McAdams, Jones & Laughlin Supply Co.; and regent, Howard B. Book, Reed Roller Bit Co. The annual election was held at Sherry's on January 7.

## Plan Products Line

Standard Oil Co. (Indiana) plans to build a new 316-mile 12-inch products pipeline from the Sugar Creek, Mo., refinery to Dubuque, Iowa. At Dubuque the line will join an existing products pipe line from Standard's Whiting, Ind., refinery to Moorhead, Minn. Completion is planned for early 1953.

## Book Review

A Survey of Oil Production in Oklahoma by Water Flooding, by John P. Powell and Kenneth H. Johnston, Bureau of Mines Report of Investigations, 4832, 142 pages (1951).

This survey contains a description of all water flooding projects in Oklahoma except those in Nowoto, Rogers and Craig Counties. The present report covers 87 different projects; in each case a summary is given of the results obtained by water flooding, with information on the producing formations, methods of development, production practices and sources and treatment of water for the many active flood projects. In the past few years water flooding activities in Oklahoma have increased several fold. It is being practiced in 25 of the 49 oil producing counties. Up to the end of 1949, about 33 million barrels of oil, or 1,800 barrels per acre, had been produced from the 18,221 productive acres, for which there was required about 449 million gallons of flood water.

## Errata

A tabulation showing the consumption of principal petroleum products in India in 1949 and 1950 given on Page 35 of the January, 1952 number of WORLD PETROLEUM contained several errors. Consumption of lubricants, asphalt, grease, wax and specialties was incorrectly stated. Following are the correct figures:

| | Barrels | |
|---|---|---|
| | 1949 | 1950 |
| Lubricants | 1,060,000 | 897,000 |
| Asphalt | 439,000 | 353,000 |
| Grease, Wax & Specialties | 329,000 | 331,000 |
| Total | 24,282,000 | 25,794,000 |
| Barrels Daily | 66,500 | 70,700 |
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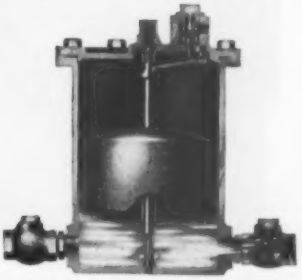

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# Oil company staff changes

**ANDREW NEILSON** has been elected a vice president and director of the Caltex Group of companies. He will continue as president of Overseas Tankship Corp., an affiliate of Caltex, which provides transportation of petroleum products for the Caltex Group from Bahrein and the Arabian fields to points as widely separated as Europe and Australasia.

Mr. Neilson went to sea in 1922 immediately after graduation from high school. He sailed on various types of ships, including sailing, freighters, passenger, tankers, etc., to virtually all major world ports. In 1928 he received his second mate's license and sailed as officer for five years with the Standard Oil Co. of Calif. During this time he sailed as third officer, second officer and chief officer on some of their largest tankers. In 1932 he obtained his master's license and pilot's licenses for several ports.

Mr. Neilson left the sea in 1934 to complete has education, and after graduation from Stanford in 1938 he rejoined Standard of California's marine department. In 1943 he participated in the formation of Pacific Tankers at the request of the War Shipping Administration. In 1946 he joined Overseas Tankship Corp. as vice president, and was appointed president in Dec. 1947.

A. Neilson

**GEORGE W. OLIVER** has been appointed Southwest Texas division superintendent for Humble Pipe Line Co. He joined the company in 1923 in Corsicana, and has been sent to various pipe line stations and offices throughout the state. His headquarters are now in Corpus Christi.

Hickman E. Hensley was named assistant division superintendent for West Texas. He has recently been Odessa District superintendent and is moving to Midland. Replacing Mr. Hensley in Odessa will be P. Harold Yolland, who was assistant district superintendent in Pierce Junction.

**H. S. M. BURNS**, president of Shell Oil Co., has been appointed chairman of the public relations committee of the board of directors of the American Petroleum Institute by Chairman L. S. Wescoat. He succeeds John M. Lovejoy, president of the Seaboard Oil Co. of Delaware, who had served as chairman since 1947. The public relations committee is the board group to which the Oil Industry Information Committee reports.

**M. V. JOHNSTON** has been made acting general credit manager for the Gulf Oil Corp. in the absence of R. R. McCoy who is on sick leave. J. S. Neff was named assistant general credit manager for the corporation.

## Rockwell Reorganizes Sales Department

Rockwell Manufacturing Co. has completed a country-wide reorganization of its sales department. Five regional managers have been appointed. The Eastern Region will be under the direction of M. J. Harper with headquarters in New York City. The Central Region will be supervised by P. C. Kreuch with headquarters in Pittsburgh. The Southern Region will be headed by J. W. Northcutt with offices in Atlanta, Ga. The Mid-Western Region will be under the jurisdiction of C. K. Madison with offices in Houston, Texas. The Western Region will be managed by H. Boezinger with offices in Los Angeles, California.

## Du Pont Promotions

Four members of Du Pont's petroleum chemicals division were advanced to new posts, effective January 1. T. Baldwin Prickett was named planning manager; Robert F. Harwick became sales promotion manager; Richard O. Bender was appointed assistant technical manager; and Arthur F. Bowe, formerly manager of the eastern district laboratory at Deepwater Point, N. J., was appointed laboratory coordinator.

**BAIRD H. MARKHAM** has retired as director of the American Petroleum Industries Committee of the American Petroleum Institute. He had been head of the committee since it was organized 19 years ago. Previously he had been with Continental Oil Co. and its predecessor Marland Oil Co. He was organizer and commanding general of the 45th infantry division of the national guard and served as Oklahoma state adjutant general. He was honored at a dinner by oil industry associates on December 12. General Markham's successor as director of APIC is John H. Bivins, formerly associate director.

**HOWARD INGERSOLL** has been appointed assistant general manager of the domestic sales department of The Atlantic Refining Co. He has been serving since 1931 as manager of the company's southern marketing region and has been with Atlantic since 1915.

**HARRY DERENIUK** has been promoted to chief primary engineer of Deep Rock Oil Corp. He was formerly district engineer at Wichita Falls, Texas. Mr. Dereniuk is a native of Saskatchewan and during World War II served in the Royal Canadian Air Force.

**FRANK C. COLEGROVE** has been named to the newly-created post of executive vice president of Allied Oil Co. Inc., Cleveland. Mr. Colgrove came to Allied in 1944 as manager of supplies. He was named assistant to the president in 1948 and appointed vice president in 1950. During World War II he helped to organize the inland waterways section of the transportation division of the Petroleum Administration for War.

**WILLIAM R. STOTT**, northern region sales manager of Esso Standard Oil Co., has been appointed assistant marketing coordinator of Standard Oil Co. (N.J.). During the past 22 years, he has been assigned to Esso's domestic marketing divisions. Mr. Stott started his Esso career as a salesman in the Pennsylvania division in 1929. He joined the New Jersey division at Newark a year later and successively served as district manager, merchandising manager and division manager. He became region manager two years ago.

W. R. Stott

**W. F. MOORE**, president of Arabian American Oil Co., has announced three appointments to newly created positions as general managers.

R. S. Hatch, who joined Arabian American in 1947 after 20 years of association with The Texas Co., becomes general manager for materials, supply and traffic.

Dale Nix, whose experience in the oil industry extends over 25 years and who has been a member of the Aramco organization since 1940, is made general manager of oil operations.

George Kraigher, with a background of many years of military and commercial flying, has been appointed general manager of aviation. He has been in charge of the company's air operations since 1948.

Mr. Moore also announced the appointment of D. M. Brown as manager of producing pipe lines and transport, and of Dr. Theodore E. Allen as associate medical director. Mr. Brown came to Aramco in 1936 from Standard of California. Dr. Allen, a specialist in industrial medicine, joined Aramco, 1949, as assistant medical director.

D. Nix G. Kraigher R. S. Hatch

## OIL AND THE WATERFALL

THIS 22-million-gallon-a-day "waterfall" in one of the cooling towers at Anglo-Iranian's oil refinery in South Wales is part of an expansion project that has already raised the refinery's production to twelve times its pre-war rate.

This in turn forms part of a greater expansion programme on a world-wide scale. Anglo-Iranian and its associated companies operate nine refineries in the United Kingdom, France, Germany, Italy and Australia. A tenth refinery has just gone on stream in Belgium and another new refinery is under construction now in the United Kingdom.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

# Anglo-Iranian Oil Company

LIMITED

REPRESENTATIVE IN THE U. S. A.: W. D. HEATH EVES, 610 FIFTH AVENUE, NEW YORK 20, N. Y.

F. L. Goldsby

## Succeeds Robinson At Chicago Bridge

Fred L. Goldsby has succeeded W. D. Robinson, who retired Dec. 31, in the Chicago Bridge and Iron Company's export department in New York. Mr. Goldsby started with Chicago Bridge in 1927 and worked in the Chicago shop, operating department, drafting room, research and development department, was assistant to the chief engineer, and has been in charge of the foreign erection department at New York since 1947.

**P. W. JUDAH** has been appointed manager of the lubricating department of Socony-Vacuum Oil Co. Inc. He succeeds Paul V. Keyser, Jr., who was recently appointed general manager of domestic marketing. Mr. Judah, who has been manager of the industrial division of the lubricating department since 1949, has been associated with Socony-Vacuum since 1932, when he became a service station attendant at Elmira, N. Y.

**P. C. THOMAS** has been appointed general sales manager of Shell Oil Co. for the Eastern United States. In the absence of the vice president, he is in charge of Shell's marketing activities nationwide. He succeeds H. G. Swanson, sales manager since 1948, who retired December 31. Mr. Thomas came to New York from San Francisco, where he has been sales manager of Shell's Pacific coast territory for the past four years.

## Largey Named Salesmanager

W. Edward Largey has been appointed general salesmanager of Petroleum Engineering Associates, Inc. and Oil Properties Consultants, Inc., Pasadena. This was announced by Florent H. Bailly, president of the companies. Mr. Largey formerly was advertising director of Byron Jackson Co. and Emsco Derrick and Equipment Co.

W. E. Largey

**ALEX. CLARK** of Casper, Wyo., has been appointed a director and vice president in charge of exploration of Federated Petroleums Ltd. For the past five and one-half years Mr. Clark has been division geologist of the Shell Oil Co. in the Rocky Mountains. From 1941 to 1943 he was in charge of exploration for Shell in Canada.

Mr. Clark will remain in Casper where he will head an intensive exploration program on Federated's 600,000-acre holding in the Williston Basin area in Montana, North and South Dakota and Saskatchewan.

**CYRUS S. GENTRY,** vice president and general counsel of Shell Oil Co., has been elected chairman of the American Petroleum Industries Committee of the American Petroleum Institute. He succeeds Oscar John Dorwin, vice president and general counsel of The Texas Co., who has served as chairman during the past three years, and will now continue as a committee member. Joseph P. Walsh, general counsel of Sinclair Oil Corp. was elected secretary to replace Mr. Gentry.

**ROBERT L. MINCKLER,** president of the General Petroleum Corp., has been elected to his second term as president of the Western Oil and Gas Association. L. L. Aubert, president of the Bankline Oil Co., was elected first vice president and Charles S. Jones, president of Richfield Oil Corp., was elected second vice president. L. K. Whittier, vice president of the Belridge Oil Co., was re-elected treasurer and John M. Peirce was re-elected vice president and general manager.

Harry J. Lemmer

## New Waukesha Motor Advertising Manager

The Waukesha Motor Co. has appointed Harry J. Lemmer as advertising manager. Mr. Lemmer entered the Waukesha Motor organization in 1942. During the war he acted as technical information manager and supervised the publication of technical manuals ordered by the Armed Services using Waukesha engines and power units all over the world. In 1946 he became assistant advertising manager.

**C. H. TEW,** manager of cost and economics of Canadian Oil Companies Ltd., is now in Washington, D. C., acting as representative of the Canadian Petroleum Division of the Department of Defense Production. He will be on loan to the government for a period of six months. Mr. Tew has had 18 years of service with Canadian Oil Companies, Ltd. as chief auditor, chief accountant and manager of cost and economics.

**LEE A. CHRISTIANSEN** has been appointed assistant general traffic manager of Sun Oil Co. Mr. Christiansen has been active in the transportation field for 20 years and had served as an assistant traffic manager for Sun since July, 1950.

D. R. Cumming

## Cumming Heads Oilwell Export Sales

The promotion of D. R. Cumming from sales manager to division manager of Oil Well Company's export division has been announced by K. B. Winstead, general manager of sales. Export division headquarters are in New York City.

Mr. Cumming succeeds M. E. Keenan, who retired after more than 30 years of service.

Mr. Cumming attended the U. S. Naval Academy at Annapolis and spent three years with Lago Petroleum Corp. in Venezuela before joining Oilwell in 1937. He represented the company in Trinidad and later London and returned to New York City in 1939. The following year he transferred to Buenos Aires, remaining there until 1942 when he entered the Navy.

Mr. Cumming served with the Navy until November, 1945, when he was discharged with the rank of Lieutenant Commander. He was named sales manager of the export division upon his return from the service.

**DR. CHARLES L. THOMAS** has joined the research and development staff of Sun Oil Co. For the past six years he has been director of research and development for the Great Lakes Carbon Corp. Previously he was with Universal Oil Products Co. where he did outstanding work on catalysts and catalytic processes for petroleum refining.

## White Names South American Manager

Charles H. Miller has been named manager of the South American division of the overseas operations of The White Motor Co., with headquarters in Rio de Janeiro, it was announced by T. T. Harrow, White director of export. Mr. Miller has been export service manager and export coach sales manager. He has traveled extensively in South America in those capacities.

Charles Miller

PETROLEUM CHEMICALS DIVISION
# DU PONT NEWS

February ★ One of a Series of Interest to the Petroleum Industry ★ 1952

## Automobile Manufacturers Make Use of DuPont Movie for Service Managers Clubs

Du Pont's movie, "What Makes A Gasoline Good?", was introduced in August 1950 as a means of helping oil companies teach service station personnel more about the basic product they sell. By the end of 1951, 188 prints were in circulation and in continuous demand.

When the film was shown recently to the national service managers of seven of Detroit's large automobile manufacturers, these men immediately recognized its value as an instruction and entertainment medium for their respective district service managers clubs.

It has been found also, that among automobile dealer service personnel, the film is an excellent medium for explaining how gasoline is made, how it is blended for seasonal variation, and what the differences are between regular and premium gasolines.

Oil companies benefit from such showings because automobile mechanics, armed with a better knowledge of the care and research which go into the blending of gasoline, are less likely to blame the fuel for shortcomings that are due to faulty timing, old spark plugs, or other types of mechanical maladjustment.

## Has 25 Years Experience in Petroleum Chemicals Research

**CHARLES J. PEDERSEN,** now a research associate studying the mechanism of oxidation at Du Pont's Jackson Laboratory, was one of the early scientists in America to work on the commercial development of tetraethyl lead. Throughout his 25-year career, devoted almost exclusively to petroleum additive research, Mr. Pedersen has made many contributions to the petroleum industry. In addition to improvements in tetraethyl lead manufacturing, his 29 patents relate to such diverse fields as the development of gasoline antioxidants and metal deactivator. He is also responsible for inventions applying to lubricant additives and corrosion inhibitors for antifreeze solutions.

Mr. Pedersen, who is a member of the American Chemical Society and the American Association for the Advancement of Science, joined the Du Pont Company in 1927 after receiving his master's degree in chemistry from M.I.T.

# From Swamp to Blending Plant! . . . Du Pont Helps Marketer Solve Unusual Problem

A large marketer needed a new tetraethyl lead blending plant. But two major obstacles stood in his way. The only site available for the building was a swampy lot near his bulk plant . . . and the area was highly congested with fuel storage tanks. The swamp presented an unusually difficult construction problem, the congestion a fire hazard.

**COMPLETED AND READY FOR OPERATION, this modern blending plant was specially designed and built to the customer's particular needs. It is one of many such plants constructed with Du Pont help in the past 12 months.**

To the marketer, it looked as if he were stymied so he came to Du Pont for help.

### SPECIALLY DESIGNED

Du Pont is always prepared to furnish standard blending plant plans to any refiner or marketer. But this job called for a special design. Fortunately, tough problems like this are part of the daily routine for technical service representatives of the Du Pont Petroleum Chemicals Division and the whole project was planned in detail by Du Pont designers before construction began. Even recommendations for materials and equipment were included in the plans.

Because of the swamp, extra-strong piling was required to support the foundation. First, 19 ordinary wood piles were driven into the ground. These were then reinforced with iron bars and cement. The bars were laid across the top of the piles before the cement was poured into wooden forms built around the piles.

**DU PONT REPRESENTATIVES Arthur C. Santora and Robert E. Holston discuss plans in detail with the superintendent of construction.**

To overcome the congestion problem, Du Pont designers took measures to increase the fire resistance of the blend-

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED **Blending Plant**

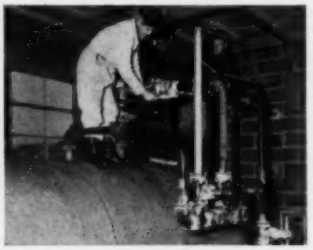
ing building. And throughout the construction, a Du Pont representative was on hand to advise the building crew. On such a job, his services include inspection and testing of equipment, as well as advisory help during the construction stages.

**PERSONNEL TRAINING**

In addition, as a final step, Du Pont representatives are prepared to train blending personnel in the safe and efficient operation of the unit. And for the customer's convenience, special equipment such as scales, weigh tanks, and pipe connections are obtainable through Du Pont.

SPECIAL PILING is required for construction in swampy land. It is made by pouring concrete over ordinary wood piles. The cement "caps" are also reinforced with iron bars.

THE BIG WEIGH TANK is eased onto cradle of scales by a crane. Because of the nearby fuel storage tanks, extra fire resistance is built into the cinder block walls.



A CAREFUL CHECK for leaks is made by Du Pont representative Robert Holeton. All valves and pipe connections are first soaped by the workman to make the check absolutely sure.

FINAL INSPECTION by Mr. Holeton helps assure that there is no foreign matter left in tank to clog valves. After this, the tank is permanently sealed for operation and no one is permitted to enter.

INTERIOR OF THE NEWLY COMPLETED blending plant. Extreme care is exercised to keep such plants immaculate since "good housekeeping" and safety go hand in hand in tetraethyl lead blending operations.

## Fast, Reliable Tetraethyl Lead Deliveries Assured by Du Pont's "Warehouse-on-Wheels"

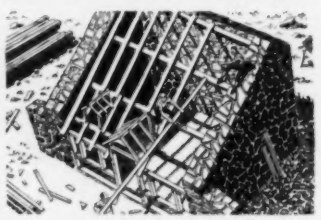
When you need an extra supply of TEL, or want a delivery faster than previously scheduled, there is a Du Pont TEL car, already loaded and strategically located at a rail siding ready for delivery to your plant.

For your convenience, and to meet emergency conditions, there are such Du Pont sidings in, or adjacent to, major refining areas. An ample supply of both Motor Mix and Aviation Mix is constantly maintained at these sidings. And there is someone at the phone to expedite your order at any time of the day or night.

Further, to meet the constantly growing customer demand, Du Pont recently expanded its TEL tank car fleet. All these "warehouse-on-wheels" facilities mean that you can receive Du Pont TEL *at your convenience*, rather than according to inflexible and sometimes inconvenient schedules.

Du Pont also maintains fully-stocked Petroleum Chemicals warehouses in Houston and Los Angeles, as well as in Wilmington. A month's supply of the complete line of Du Pont additives is always on hand at these strategically located shipping points.

## Du Pont Historical Highlights



Powder mills such as those built by E. I. du Pont in 1802 had never been seen in America. The Du Pont mills were made of extra-heavy stone walls on three sides and flimsy framework on the fourth side and roof. Thus, if an explosion occurred, its chief force would be upward and away from other buildings—an important safety factor.

Such precautions, at the very outset, helped establish the pattern for a continuing safety program that soon placed Du Pont among the leaders in safety procedure.

Long experience in the handling of highly toxic chemicals put Du Pont in a position in 1923 to set up the only safe method for the manufacture of tetrathyl lead compounds.

Today, Du Pont not only maintains an outstanding safety record in its own plants, but also employs a staff of medical and safety advisors on call to help refiners guard the health and safety of their TEL blending personnel.

DU PONT
REG. U. S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

# Petroleum Chemicals

**E. I. DU PONT DE NEMOURS & COMPANY (INC.)**
*Petroleum Chemicals Division* • *Wilmington 98, Delaware*

*District Offices:* New York, N. Y. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

*District Laboratories:* Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

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A-2983

Printed in U. S. A.

## Zubair Field

*(Continued from page 37)*

granted nearly fourteen years before the first oil was loaded out for market. Millions have been spent in drilling and in the erection of field installations such as workshops, water supply facilities, a power station, pumping and pipe line equipment, housing and ancillary services. Present company personnel in the field includes about 2,500 Iraqi and some 200 foreign engineers and management people.

Basrah Petroleum Co. Ltd. is a sister company of Iraq Petroleum Co., which has a 32,000 square mile concession in the provinces of Baghdad and Mosul east of the Tigris river. Another company of identical stock ownership is Mosul Petroleum Co., Ltd., which holds a concession of 40,000 square miles west of the Tigris and north of Latitude 33.

Recently the three companies renegotiated the terms of their respective concessions to bring royalty payments in line with the level of those paid certain other countries such as Saudi Arabia and Kuwait. Producing obligations and other terms differ in each case, but the main outlines are identical.

Stock ownership in the three companies is held by Anglo Saxon Petroleum (Shell); D'Arcy Exploration (Anglo-Iranian); Cie. Francaise des Petroles; Near East Development Corp. (Socony-Vacuum and Standard Oil Co., N.J.); and Participations and Investments Ltd. (C. I. Gulbenkian). Each of the above owns 23.75 percent of the stock, except Gulbenkian, five percent.

## Israel Seeks Mexican Oil

Israel will ask Mexico for at least part of the 60,000 additional barrels of crude a day it needs to keep its Haifa refinery running at full capacity. At present, the Haifa refinery is reported to be operating at only one-quarter of its capacity due to the refusal of Arab states to permit their crude to be sold to the Jewish State.

Israel is said to have offered Mexico a guaranteed annual purchase of 10 million barrels, to be paid for in dollars. At present, Israel is reported to be receiving 20,000 barrels a day from Venezuela.

Other countries reliably reported to be seeking Mexican crude are Argentina, which is said to be trying to buy 2,000,000 barrels, France, Belgium, and Western Germany, which are said to be proposing to exchange drilling equipment, line pipe, agricultural machinery and other goods for Mexican oil.

Oil for Today . . . and Tomorrow
A Search of 127,000 Square Miles
an area as great as the combined areas of . . .
OKLAHOMA
NEW YORK
CONNECTICUT
DELAWARE

Twelve years ago you could have counted the number of technical personnel engaged in oil exploration in Mexico not just on your fingers —but on your ears. There were only two!

Today a thousand men are searching for new reserves of oil—using the most advanced methods and instruments. At the top are 132 Mexican geologists, geophysicists, geochemists and other experts.

Since 1946, such exploratory work has resulted in 24 new oil and gas fields. Now, more than 100 geologically favorable structures await testing by drilling.

*These structures have been found by scientific study of 127,000 square miles—an area as great as that of the states of Oklahoma, New York, Connecticut and Delaware combined.*

More than five million dollars is being spent for geological and geophysical work by Petroleos Mexicanos this year alone.

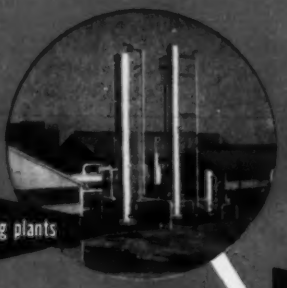
Mexico's drilling rig crews are busy finding oil for today. Mexico's exploration brigades are busy finding oil for tomorrow.

**PETROLEOS MEXICANOS**

MEXICAN PETROLEUM ADMINISTRATION

*In the 50 years since Spindletop*

# Fluor is proud to have served the



gas treating plants

Over a billion and a quarter SCF/D designed capacity!

gas compressor stations

Over 200,000 installed horsepower (Excluding units in gasoline plants)

fl SINCE 1890

natural gasoline plants

One billion, one hundred and nine million SCF/D designed capacity!

crude oil units

(Distillation and Stabilization) Over 389,000 BBL/D capacity!

**SPECIAL PRODUCTS FROM GAS**

Special plants designed and/or constructed by Fluor include complete installations for the recovery of sulfur, carbon dioxide, carbon black and helium. Fluor is the sole licensing agent of The Mathieson Sulfur Recovery Process for the recovery of pure elemental sulfur from waste hydrogen sulfide.

processing units

(Including polymerization, isomerization, fractionation, alkylation, etc.) Over 100,000 BBL/D capacity!

**FLUOR**

BE SURE WITH FLUOR

fl

# petroleum industry in these many ways

The steady growth of The Fluor Corporation goes hand-in-hand with that of the petroleum industry since the first *big* discovery of Texas oil at Spindletop. Fluor's engineering and construction personnel were engaged primarily in heavy industrial construction just prior to Spindletop. Soon after Spindletop, the company's engineering and construction skills found ready acceptance by the rapidly expanding petroleum industry.

First contracts called for the design and construction of gas compressor stations. Next came work in gasoline processing plants. Then followed the design, engineering and construction of major refining units. Today Fluor is recognized as one of the nation's major engineering and construction organizations. Whatever your plans might include—a completely integrated plant or the expansion of existing facilities—Fluor's accumulated experience in the petroleum refining, gas-gasoline and chemical processing industries is at your disposal.

catalytic cracking units

Over 75,000 BBL/D Capacity!

**ALLIED PLANTS AND FACILITIES**

Fluor has designed, engineered and/or constructed plants and facilities for the processing and production of ammonium sulfate, sulfuric acid, liquid $CO_2$, toluene, and paraffin and crystalline waxes, as well as plants for the blending, compounding and packaging of lube oil and greases.

**FLUOR LITERATURE AVAILABLE**

*Catalogs and bulletins—describing Fluor's engineering and construction activities for the petroleum industry, and Fluor specialized products—appear in current issues of Sweet's Catalog (Process Industries Section), Chemical Engineering Catalog, and Refinery Catalog—or request individual copies.*

## *Fluor's manufactured products were first designed for the Petroleum Industry*

**COOLING TOWERS**

Fluor Cooling Towers were the first "engineered" cooling towers to be installed at Signal Hill, California in 1921. They are now in service throughout the world in virtually every industry utilizing water as a cooling medium.

**FIN-FAN COOLING UNITS**

Fin-Fan Air-Cooled Heat Exchangers were pioneered by Fluor and The Griscom-Russell Company in 1941. It was the first air-cooled heat exchanger to answer industry's need for a compact, low-maintenance unit utilizing air as the cooling medium.

**PULSATION DAMPENERS**

In 1943, Fluor pioneered the development of a pulsation dampener to remove gas stream pulsation and consequent vibration in compressor piping. Fluor continues its leadership in this field.

**FLUOR MUFFLERS**

The first Fluor Mufflers were placed in service in a gasoline plant in 1926. Now Fluor offers two basic types: A single-element muffler and a dual-element muffler. Each type solves specific muffling problems and both offer industry the highest muffling efficiency obtainable.

**OTHER FLUOR PRODUCTS**

In addition to the products outlined at left, Fluor has long been identified as manufacturers of Gas Cleaners and other special equipment related to the oil, gas, chemical and allied industries.

DESIGNERS AND CONSTRUCTORS of Refining, Natural Gas and Chemical Processing Plants.
MANUFACTURERS of Pulsation Dampeners, Mufflers, Gas Cleaners, Cooling Towers and Fin-Fan Units.

THE FLUOR CORPORATION, LTD., 2500 S. Atlantic Blvd., Los Angeles 22, Calif. Offices in principal cities in the U.S.A.
REPRESENTED IN THE STERLING AREAS BY: Head Wrightson Processes Ltd., Teesdale House, Baltic St., London, E.C.1., England

# MILLENNIUM-KEY

## PETROLEUM FITTINGS

MILLENNIUM KEY

Cast Steel Fittings for oil refinery and chemical plants are manufactured throughout at Braintree by Lake & Elliot Ltd. Close metallurgical control is maintained by competent chemists working with modern apparatus. The independent inspection department can carry out inspection, or work in conjunction with customers own inspectors.

Lake & Elliot Ltd.
BRAINTREE ENGLAND

# Descale WITHOUT Danger

SKATOSKALO

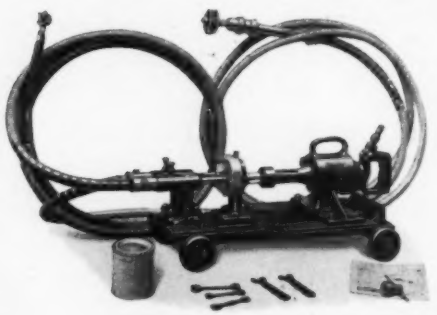
## Use AIR-DRIVEN "SKATOSKALO"

THE Air Motor "Skatoskalo" Set enables the operators to de-scale and clean tubes in the shortest possible time with the greatest efficiency. The air motor gives more horse-power and does not stall when heavy deposit is encountered.

The Air Motor Driven Set incorporates all the advantages of a Rotary Air Tool without sacrificing the advantages of the electrically-driven Flexible Drive type.

"Skatoskalo" equipment can be used with complete safety and is recommended for the efficient maintenance of cracking plant, boilers, evaporators, condensers, heat exchangers, etc.

Tubes of 5/8" internal dia. upwards can be thoroughly cleaned by "Skatoskalo" Air Tools.



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Representatives in all parts of the United Kingdom. Principal agents in over sixty countries throughout the world.

**Please write for Catalogue WP stating your requirements.**

*meet*
*Fred E. Romberg...*

GSI's Southern Division Manager. Supervisors Clark Allen, Virgil Teufel, Earl Thomas, and Ray Wright complete the Division staff. When you explore for petroleum in the Southern States, their responsibility is to provide you with *personalized seismic services backed by all GSI facilities.* Whether your current exploratory problem is reworking older proven areas or taking long strides into the unknown, Romberg's nineteen years of practical experience added to the fifty-four man-years' experience of his staff, typify GSI's ability to focus real and proven talents on your most difficult problems.

FREDERICK E. ROMBERG
SOUTHERN DIVISION MANAGER

**GEOPHYSICAL SERVICE INC.**
6000 LEMMON AVENUE • DALLAS, TEXAS

**SOUTHERN DIVISION OFFICE: 839 ESPERSON BUILDING, HOUSTON 2, TEXAS**

Max T. Bruner

**MAX T. BRUNER** has been appointed vice president in charge of field construction of Refinery Engineering Co., Tulsa. Mr. Bruner has been with Treco since 1942. He has served as chief engineer in charge of engineering design and chief estimator.

## New Clark Export Company

A new corporation, Clark Bros. Pan American, Inc., has been formed to act as the export corporation in Mexico and South America for Clark Bros. Co., Inc., Olean, N. Y., and will sell the engine and compressor products manufactured by that company, exclusively. The new corporation will handle all service and warehouse facilities in South America.

No change is contemplated in the sales and office personnel now serving the South American petroleum, gas and industrial fields. F. W. Laverty is president. Offices will be maintained in Mexico City, Caracas, Buenos Aires, Bogota, Lima, and Rio de Janeiro.

## Receives French Awards

Professor Vladimir N. Ipatieff, director of Chemical research for Universal Oil Products Co. and director of the Ipatieff high pressure and catalytic laboratory, department of chemistry, Northwestern University, has been awarded two high honors in France in recognition of his work in aviation gasoline. He has been named a Chevalier of the Cross of Lorraine and Companion of the Resistance, the top distinction of the knighthood. He is the fortieth person and the twelfth American to receive the cross. General Eisenhower, A. H. Compton, and the late President F. D. Roosevelt are among the other Americans who have been awarded this honor.

The French Association of the Knights of Cyprus and Jerusalem has also awarded Professor Ipatieff its Ordo Cypri Hierosolymorumque.

## Phillips "66" Observance

The number "66" has long been a symbol used by Phillips Petroleum Co. in connection with its products. In recognition of the expansion of its stockholding family, the company last month paid a special tribute to Mrs. Roma N. Hawkins, 66 year old dean of women at MacMurray College, Jacksonville, Illinois, who became the 66-thousandth shareholder a few months ago. Mrs. Hawkins was a guest of the company on a visit to some of its plants and the home offices at Bartlesville, Oklahoma, and on a trip to New York which included a personal inspection of the New York Stock Exchange, luncheon with its president, G. Keith Funston, and entertainment at the Waldorf Astoria.

## District Manager Retires

G. B. Strausner, Pittsburgh District sales manager for The Youngstown Sheet and Tube Co., has retired after 40 years service with the company. A. S. Hare, who has been assistant district sales manager, succeeds him.

Robert J. Meers

**ROBERT J. MEERS** has joined Loffland Brothers Co., Tulsa, as chief engineer. He formerly was Gulf Coast division superintendent for Union Oil Co. of Calif.

## Hydrocarbon Recovery Plant On Stream

Tennessee Gas Transmission Co. has begun operation of its $10 million gasoline plant near Gabe, Ky., which is processing natural gas passing through the Tennessee pipe line system toward the east. When in full operation the extraction plant will process about 750,000,000 cubic feet of gas daily to obtain 380,000 gallons of natural gasoline and lighter hydrocarbons. The liquid hydrocarbon stream is delivered by a 58-mile eight-inch pipe line to the new $17 million Mathieson Hydrocarbon Chemical Co. plant on the Ohio River near Brandenburg, Ky., already partially in operation.

THERE'S MORE IN THIS THAN MEETS THE EYE

To the *average* man one brand of oil looks much like any other but the oil technician knows only too well the difference there is between a bad oil and a good oil. The best are those specially designed for the job they have to do. Research and technical control alone makes that possible.

Paints may also look alike but there is a world of difference between "paint" and the *right paint for the job*. All "International" products are the result of research and technical control—they are made for the job—YOUR JOB.

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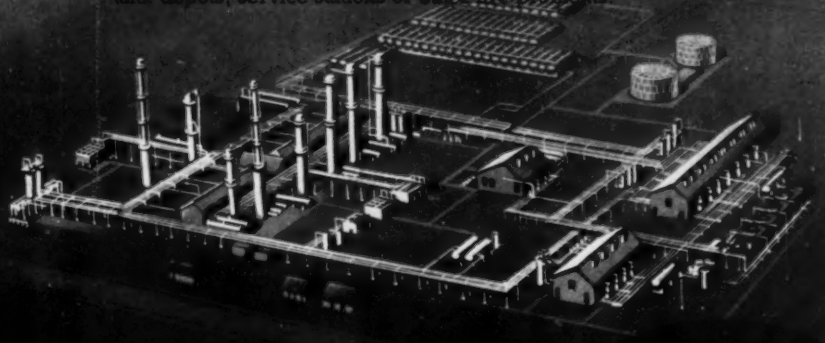

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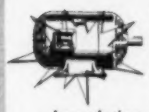

***You can't stop a motor*** from throwing sparks . . . and if there's petroleum vapor around you can't prevent the ensuing explosion. But you can make sure such explosions cause no damage —by replacing outmoded motors with Westinghouse Explosion-Proof motors wherever petroleum fumes collect. These totally enclosed, fan-cooled motors smother explosions *inside* the motor, where they do no harm.

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***Add to this important safety feature*** the rugged, compact construction of Explosion-Proof motors—heavy steel or cast iron frame, feet and end brackets for maximum strength and rigidity . . . long resistance to corrosive atmospheres. Exclusive "Tuffernell" insulation and wire covering of synthetic resin provide high dielectric strength and long life. For more information about Explosion-Proof motors write to Dept. U, Westinghouse Electric International Co.

***For safe operation*** *in explosive atmospheres, Westinghouse Explosion-Proof motors are furnished with characteristics suitable for a variety of applications. One to two hundred horsepower; 2 and 3 phase; 60, 50, 25 cycles; 208, 220, 380, 440 and 550 volts. Special voltages available on order.*

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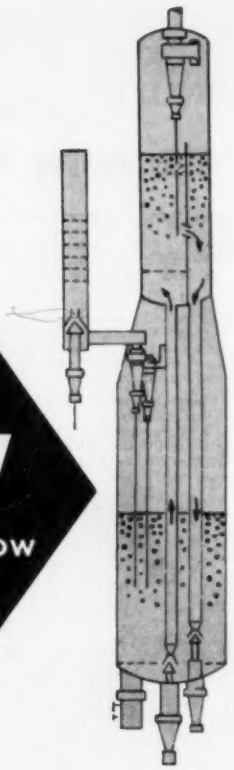
**at lowest initial cost!**

# Kellogg Orthoflow

## THE CRACKER WITH STRAIGHT-LINE CATALYST FLOW



*This cross section reveals the simplicity of the Orthoflow design. Note straight line catalyst flow . . . specially-designed valves controlling flow of catalyst and oil*

Two new Kellogg Orthoflow units have now been on stream for hundreds of days . . . a third will start operating soon . . . and more are in the engineering and initial construction stages. Although each unit is designed for a specific operation, all have two things in common: the superior efficiency and economics of the Fluid bed and low investment cost.

Superior efficiency and economics are expected of any Fluid catalytic cracking operation—but these units have an additional edge in this respect because built into them is Kellogg's entire experience, culled from engineering more than 50 Fluid units in a period of ten years . . . more than 70% of the world's total Fluid cracking capacity.

Low initial cost is also to be expected of this new Orthoflow design. *One* vessel containing both reactor and regenerator. Less steel work. Smaller foundations. Shorter and fewer catalyst carrier lines. No slide valves. Elimination of expansion joints in the catalyst transportation system.

Such features are bound to reflect favorably on initial investment. But in addition, these Kellogg engineering advances offer decreased maintenance cost because of straight line transmission of catalyst-oil mixtures and spent catalyst. Only the Orthoflow has this erosion-reducing feature. Only the Orthoflow has eliminated the maintenance problem of expansion joints, utilizing specially-designed spring-loaded valves to absorb thermal expansion.

If you are considering the addition of Fluid catalytic cracking to your processing sequence or an increase in your present cracking capacity, you should explore the advantages of the new Kellogg Orthoflow converter.

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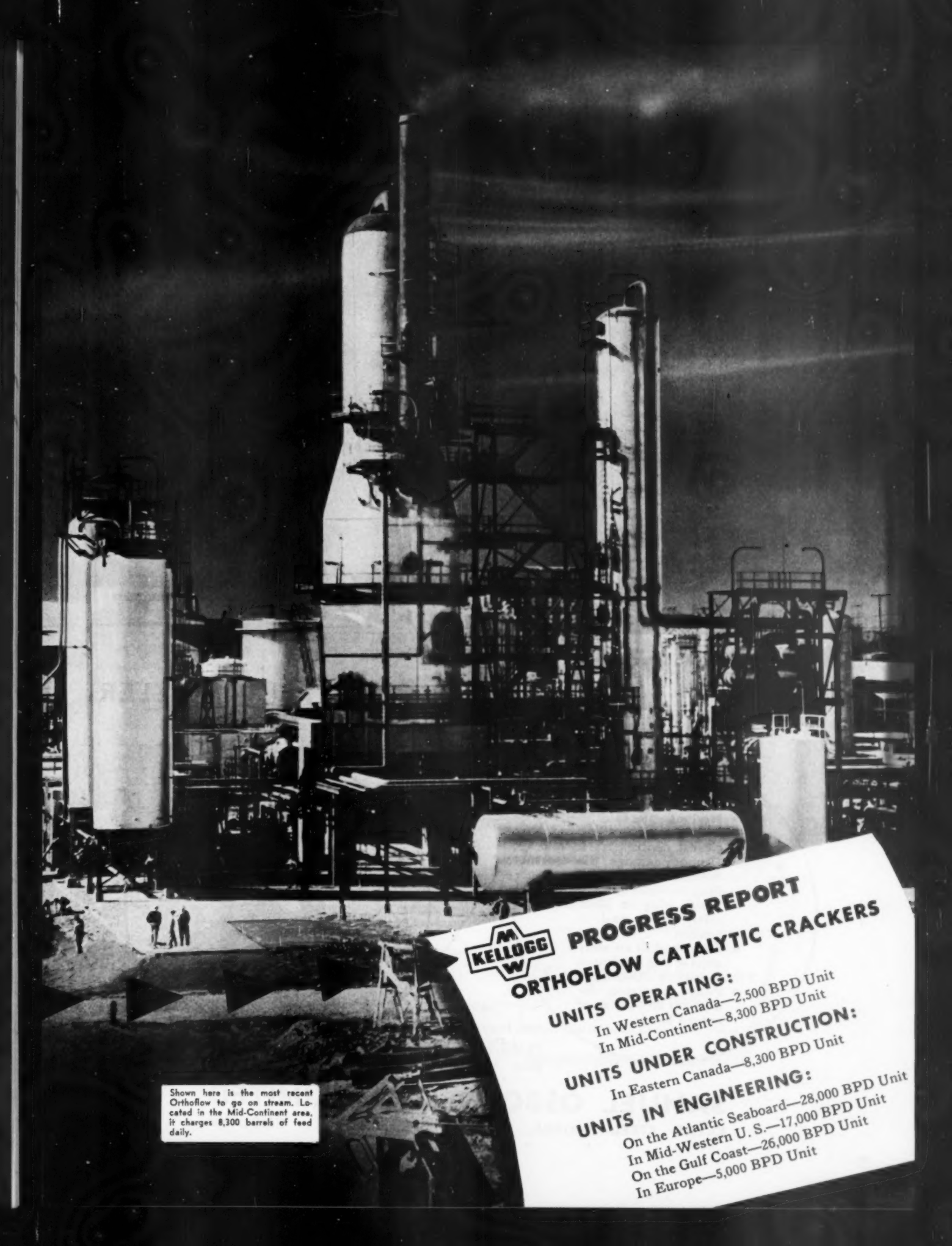

Shown here is the most recent Orthoflow to go on stream. Located in the Mid-Continent area, it charges 8,300 barrels of feed daily.

M. W. KELLOGG

## PROGRESS REPORT
## ORTHOFLOW CATALYTIC CRACKERS

**UNITS OPERATING:**

In Western Canada—2,500 BPD Unit
In Mid-Continent—8,300 BPD Unit

**UNITS UNDER CONSTRUCTION:**

In Eastern Canada—8,300 BPD Unit

**UNITS IN ENGINEERING:**

On the Atlantic Seaboard—28,000 BPD Unit
In Mid-Western U. S.—17,000 BPD Unit
On the Gulf Coast—26,000 BPD Unit
In Europe—5,000 BPD Unit

G. G. Biggar | R. G. Pearson | H. F. Mulvaney | F. H. Roberts

## Shell Public Relations Changes

G. Gordon Biggar, assistant manager in charge of special projects in the public relations department of Shell Oil Co., has been promoted to manager of public relations, New York, according to an announcement by H. L. Curtis, assistant to the president.

Robert G. Pearson, assistant manager in charge of publicity, became manager of the publicity and information division of public relations.

Hugh F. Mulvaney, who has been responsible for public relations activities in the southwestern states with headquarters in Houston, came to New York as manager of the special projects division of public relations.

Frederick H. Roberts, who has handled public relations, art and production, will assume added responsibilities as art director and head of the production and distribution section.

**FRANK E. HANSON**, superintendent engineer in the marine transportation department, Socony-Vacuum Oil Company, Inc. since 1946, retired Dec. 31. He has been associated with the company for the past 30 years.

## Tanker Movie Produced by Texaco

"Tank Ship," a new motion picture produced for The Texas Co., has been released for public non-theatrical showings. The picture, a 19-minute documentary film in sound and color, tells the story of a modern oil tanker, from the drafting board, through its construction, launching, and operation as an oil carrier.

The Texaco tank ship "Delaware" was used as the subject of the film. The film portrays a typical voyage: loading at Port Arthur, Texas, activity at sea, and docking at Bayonne, N. J., after a 1,728-mile trip.

## Pacific Valves Expands

Pacific Valves, Inc., has acquired the plant of Pacific Forge, Inc., in Los Angeles. Pacific Forge will operate as a subsidiary of Pacific Valves, employing approximately 50 employees at present with plans for future expansion. Pacific Valves recently announced the introduction of a V-port globe valve with a special disc to regulate flow. The valve was designed for throttling service.

**HERMAN E. RIES, JR.**, has been recently appointed research associate in the Whiting Research Laboratories of Standard Oil Co. (Ind.) Dr. Ries received his Ph.D. in chemistry from the University of Chicago and has been with Sinclair Refining Co. for the past 15 years.

## Westinghouse International Appointments

Robin S. Kersh has been elected executive vice president and George L. Wilcox general sales manager of Westinghouse Electric International Co.

Mr. Kersh formerly was manager of the company's steam division. He succeeds E. V. Huggins who resigned to become assistant secretary of the United States Air Force.

Mr. Wilcox joined Westinghouse in 1942 as a design engineer at Pittsburgh. The following year he transferred to the international company in New York as a product specialist and later became assistant manager of his department. In 1950 he became general manager of the Westinghouse International Development Co. Since last July he has been manager of the projects division.

R. G. Kersh | G. L. Wilcox


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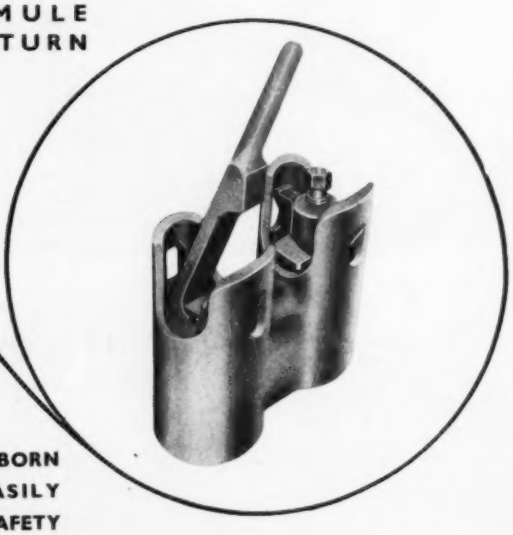

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# HOW THEY'RE SAVING SPACE AND CUTTING COST AT GUYMON WITH COOPER-BESSEMER GMW'S

Above: Five of the Cooper-Bessemer GMW engine-driven compressors in Michigan-Wisconsin Pipe Line Company's Guymon-Hugoton Station, showing units from scavenging, blower end. Each has 10 V-type power cylinders, is rated 2500 hp, and drives 3 compressor cylinders.

Shown above are five of fifteen of the Cooper-Bessemer GMW V-angle compressors totaling 37,500 compressor horsepower at work in the new Guymon-Hugoton Gas Field Station of the Michigan-Wisconsin Pipe Line Company.

Despite the relatively small space they occupy, these five units alone provide a total of 12,500 compressor horsepower! It shows that big savings can be made today in the cost of foundations, buildings and installation by taking advantage of the extreme compactness, the high power-to-space ratio of these modern V-angles.

But of course that's not all. By meeting power needs with fewer, more compact units, there's also a sizeable, long-range saving in maintenance, personnel and over all operating cost. What's more, years of field experience prove that you can always count on Cooper-Bessemer V-angles—GMW's, GMV's and GMX's—for continuous compressor performance at its trouble-free best.

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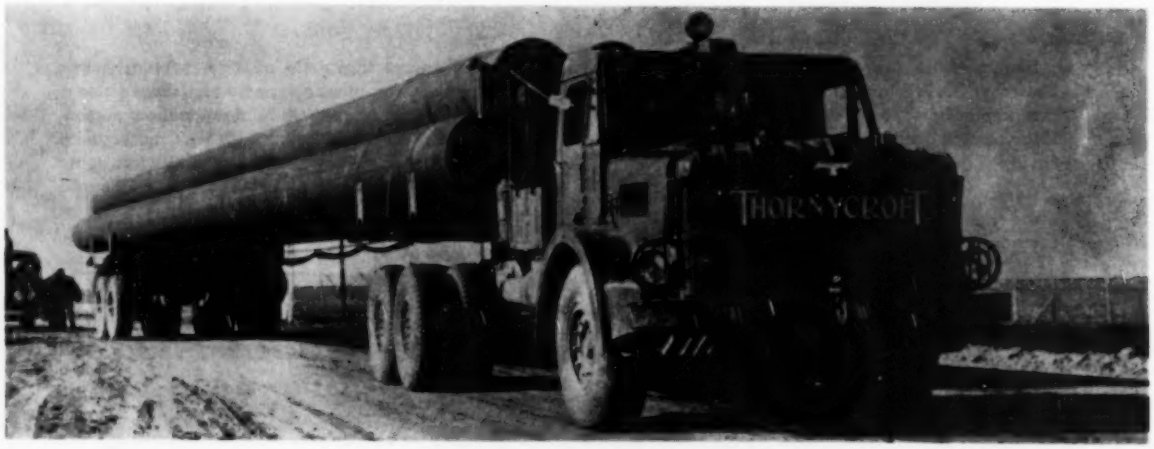


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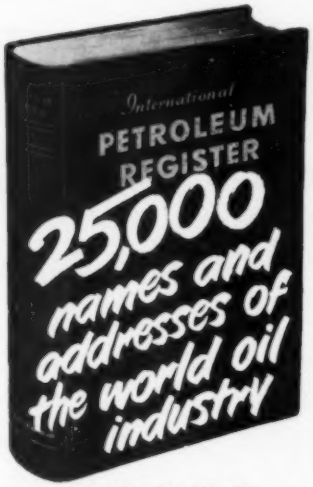


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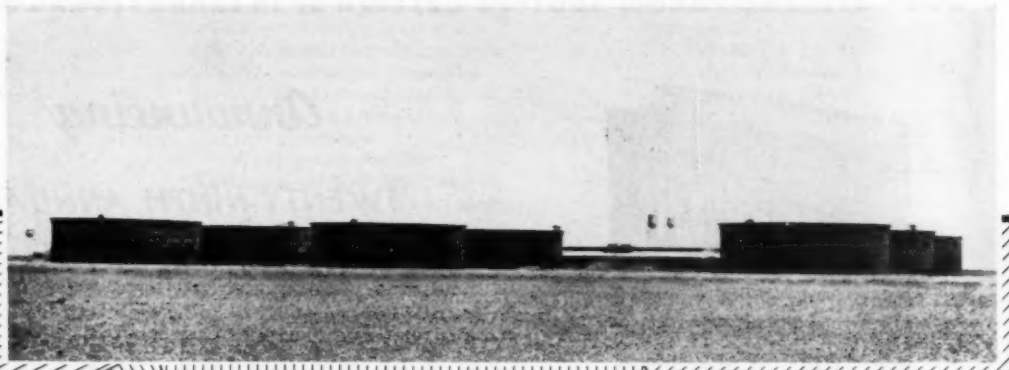

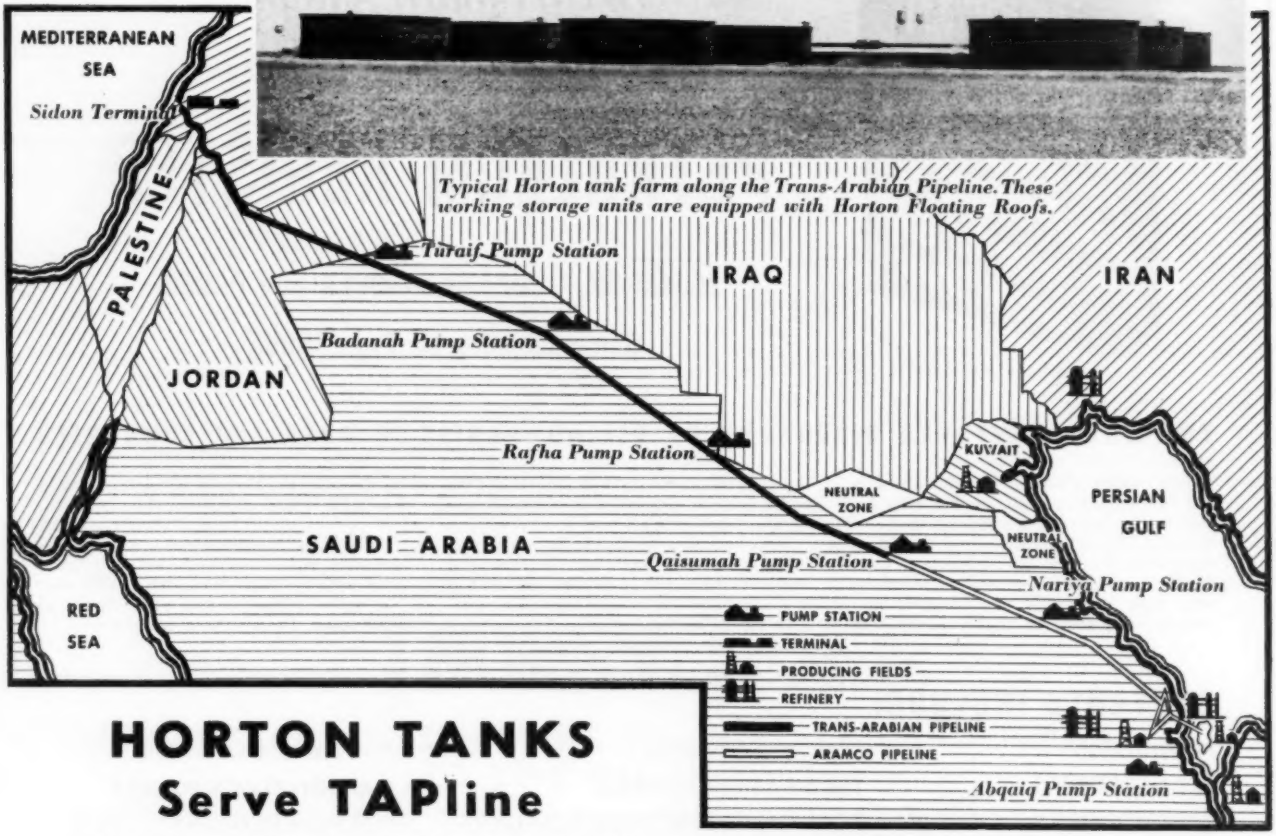


*Typical Horton tank farm along the Trans-Arabian Pipeline. These working storage units are equipped with Horton Floating Roofs.*

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*Tapline pumphouse at Qaisumah showing (left to right) two 2,000-bbl. fuel and diesel oil tanks, two elevated water tanks, and a cone roof water tank.*

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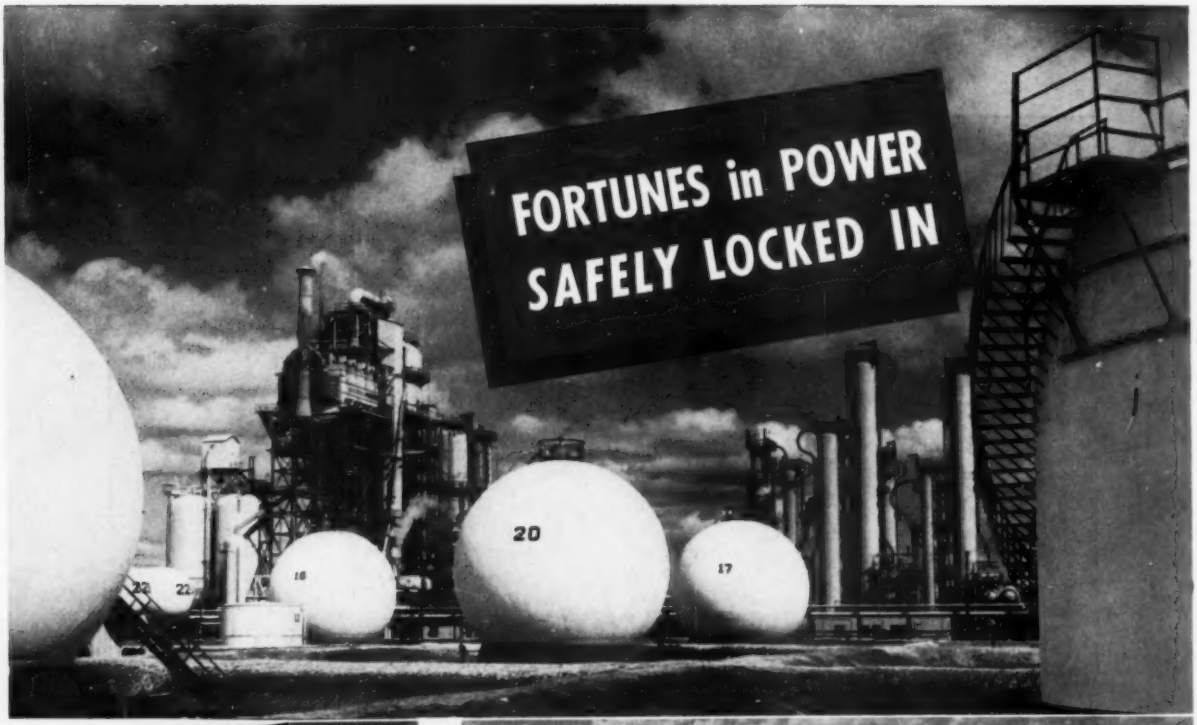

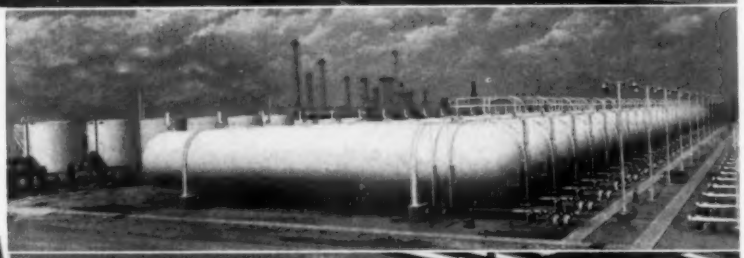

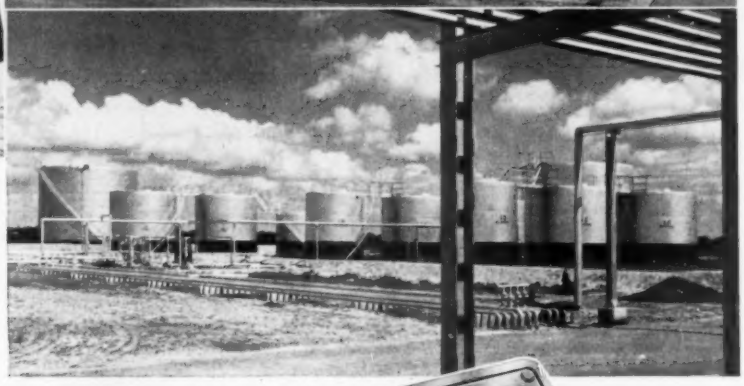

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